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Commercial Fisheries Abstracts

DIVISION OF INDUSTRIAL RESEARCH AND SERVICES
BUREAU OF COMMERCIAL FISHERIES

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Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

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Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget December 30, 1959

0.321 THE EXISTENCE OF SOME ENZYMATICALLY ACTIVE STATES OF MYOSIN WITH DIFFERENT THERMOSTABILITY

Eidus, L. Kh. and Otarova, G. K. (Institute of Biological Physics, Academy of Sciences, U.S.S.R., Moscow)
Biochemistry (U.S.S.R.) 24, 904-913 (November-December 1959)

The authors previously have demonstrated that when a solution of myosin is subjected to ionizing radiation or to visible light it becomes nonhomogenous without losing its adenosine triphosphate activity. Myosin consists of two components that differ in the size of the energy barrier ($\Delta E\neq$) and rate of reaction of thermal inactivation of the enzymes. One component is inactivated after irradiation; the other has an activation barrier to thermal inactivation several times lower ($\Delta E\neq$ ~13 kcal. per mole).

The literature includes descriptions of a sharp reduction in the energy barrier of thermal inactivation of protein with change in acidity of the medium. In a number of proteins in the native state there is some intermediate pH value below which the protein immediately would be transferred into a state with a low activation barrier for thermal inactivation.

An explanation of the mechanism of this transformation could throw a light on the mechanism of action of radiation and the nature of the "after effect." When different states occur, this could explain the specific action of these agents on the protein molecule. The investigation reported here is a study of the effect of the acidity of the medium on the kinetics of thermal inactivation of myosin.

Portions of a 0.63 mg. per ml. solution of myosin in 0.5M KCl were inactivated by heat on a water bath at pH values ranging from 5.8 to 9.5. The myosin had been obtained from rabbit muscle. The activity of myosin, determined in a borate buffer at pH 9.2, was practically independent of pH

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 ABSTRACTER: Kathryn L. Osterhaug

1.0118 GREAT LAKES TRAWLING

Sand, Reider F. (Exploratory Fishing and Gear Research, Ann Arbor, Michigan)
Fishing Gazette 77, 20-21, 117 (June 1960)

The most promising possibility for halting the decline in the Great Lakes commercial fishing industry lies in the development of a fishery for industrial fish. The chief problem in trying to develop industrial-type fisheries in this area is the inadequacy of existing fishing methods and equipment. Most of the Great Lakes contain an abundance of species that cannot be harvested profitably with traditional gear. Successful harvesting of these fish will require the use of such fishing methods as trawling and seining. Before commercial trawling will be possible, however, the industry will have to overcome several problems. The gillnet tugs, trap-net boats, and other fishing craft are too small and underpowered for conversion to commercial-scale trawling. With minor modifications, some of the medium-sized vessels could use small trawls to take some species in shallow waters during certain periods of the year. This already has been done in Lake Erie and Lake Michigan; however, the taking of significant quantities of industrial fish from deeper waters or from more distant waters will require larger and more suitable vessels.

During 1959, the possibility of taking smelt with otter trawls in Lake Erie was demonstrated by the U. S. Bureau of Commercial Fisheries. Using a converted trap-net vessel, smelt fishing grounds were located in more than one-half of the lake during the summer and fall months. New Ohio regulations, effective in November 1959, now permit trawling for smelt. The commercial use of a species previously not fished in U. S. waters of Lake Erie is now possible.

Three important questions still need to be answered. Are there sufficient resources on which to base an industrial-type fishery? Can the resources be harvested efficiently? Can the resources be marketed if caught?

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 ABSTRACTER: Kathryn L. Osterhaug

0.321 ON THE SOLUBILITY IN WATER OF THE FIBROUS PROTEINS OF THE SQUID MUSCLE PHASE-CONTRAST AND ELECTRON-MICROSCOPIC STUDY

Matsumoto, Juichiro J. and Okuyama, En iko
Bulletin of Tokai Regional Fisheries Research Laboratory No. 24, 81-84 (June 1959) (Tokyo, Japan)

In the previous study, an intense streaming birefringence (SB) was found in aqueous extracts of the squid muscle, and the presence therein of some water-soluble proteins, which are fibrous or asymmetric in nature was suggested. The present study was planned to test the existence of such proteins in the squid muscle.

When a streaming birefringent aqueous extract was examined under phase-contrast microscope, rod-like particles thinner than 3 μ and shorter than 17 μ were found, whereas no particulate matter was found in a nonbirefringent extract, the first one obtained in the repeated extractions of the squid (table 1, see over).

When examined under electron microscope, a streaming birefringent extract of the squid showed rod-like particles (R), 0.2~0.4 μ thick and 2.5~4 μ long, as well as thinner fibers which are ~400 A thick. Under electron-microscope, an extract which is not streaming birefringent showed amorphous matters and granular particles.

When the streaming-birefringent extract S_3 was subjected to centrifugation as high as 29,000 times gravity for 20 minutes, yet streaming birefringence was found in the supernatant, while an amount of protein was removed as a pellet. In its supernatant, thinner fibers as thick as ~380 A were found under electron microscope.

On the other hand, an M-actomyosin preparation isolated from the salt-extract of the squid was

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 Authors' summary

2.1124 TRAP NETS FOR LAKE WINNIPEG

Park, R. Wayne
Canadian Fisherman 47, 20-24 (June 1960)

The use of trap nets in Lake Winnipeg was authorized recently. This article describes the nets to be used this year.

Trap nets use 300- to 1000-foot webbing called leader, suspended in water to guide fish into the trap. Attached to the deep end of the leader is a Y-shaped construction called the house. The fish follow the leader and enter the house between the spread wings of the net, go through a series of baffles, and eventually enter the "crib" where they are trapped until the net is lifted.

An arrangement of anchors and buoys hold the net upright and taut in the water and, to provide additional tension, a set of spread double blocks is used at the back of the net.

When the net is to be lifted, tension on the block is released and the crib is raised to the surface.

The nets used on Lake Winnipeg will be compact and of standard design. These are straight nets with no taper in depth. The leaders on the nets ranged from 300 to 450 feet in length and from 4 to 8 inches in mesh size. Other dimensions are as follows: a net that is 8 feet in depth will have wings 10 feet long and hearts 10 feet long. The width of the house will be 8 feet and the width across the breast 12 feet. The crib will be 14 feet in length, 8 feet in width, and the funnel, 7 feet 2 inches long with a 10-inch outlet opening. Loops are attached on wings and breast corners to facilitate attaching anchor bridles and at the back of the crib are 10-inch loops, 3 at the top and 3 at the bottom,

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 ABSTRACTER: Kathryn L. Osterhaug

CHEMISTRY OF MYOSIN

SOLUBILITY OF SQUID PROTEIN

GREAT LAKES TRAWLING

TRAP NETS

0.321

extracted repeatedly with water (table 2, see over). In one of these extracts, which shows streaming birefringence, thinner fibers which are ~250 A thick were found under electron microscope.

Since it is probable that the substances contained in the extract were subjected to some deformation, for example, aggregation, as a result of the fixing treatment, the images observed in the present study may be deformed ones. Nevertheless, the present results seem to support the theory that asymmetric or fibrous proteins are responsible for the streaming birefringence which is characteristically found in the aqueous extracts of the squid. In addition, the fact that streaming birefringence survived a centrifugation at 29,000 times gravity and that thinner fibers were found in the supernatant suggests that a considerable part of the asymmetric protein is dispersed at a good stability.

Table 1.--Description of the repeating aqueous extractions of the squid muscle with water.

Extract	SB	Protein concentration	Yield, percent
S_1	-	3.3~3.6 mg./ml.	11~12**
S_2	+	1.6~1.8 mg./ml.	~ 5**
S_3	+	1.3~1.4 mg./ml.	3 ~15**
S_4*	+	0.6~1.0 mg./ml.	49~78***

* Supernatant obtained by centrifuging S_3 for 20 min. at 29,000 times gravity.
** Percentage for total muscle proteins.
*** Percentage for the proteins in S_3.

Table 2.--Description of the repeating aqueous extractions of M-actomyosin preparation of the squid.

Extract	SB	Protein concentration	Yield, percent
S_1	-	0.07 mg./ml.	7
S_2	+	0.16 mg./ml.	17
S_3	+	0.9 mg./ml.	52
S_4	+	0.9 mg./ml.	24

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to which the brails are attached.

Some modifications probably will be needed in the use of these nets in Lake Winnipeg. The kind and extent of these modifications will be determined by experience and by the conditions encountered in the lake.

The first basic modification will probably consist of the addition to the net of a second crib, immediately behind the existing crib. This will not have much bearing on loss of fish if nets are lifted every day; however, for each additional day the nets are left the percentage of loss will be far less than from a single crib design. Double crib nets are used quite extensively on Lake Erie.

A minor change which may be found desirable is the use of dropped tunnels. This possibility arises from the theory that fish entering near the bottom of the tunnel entrance will not readily rise to the outlet opening if the incline angle is too steep. Such a modification in a trap net would have to be made by replacing the tunnel with one fabricated according to the modified design. Lowering of existing tunnels could distort them and reduce the effective size of the tunnel outlet opening.

A third modification might be to increase the area of the trap house, possibly by tapering the house, lengthening the hearts and wings, or a combination of both.

In addition to the hung net as delivered from the factory, the following rigging will be required:

Anchors: Six anchors, specifically designed for trap nets, will be required for each single crib net, eight will be required for each double crib net. These anchors are of a two-fluke grapnel type.

Ropes: approximately 2,000 ft. of $\frac{1}{2}$-inch sisal or manila rope will be required for each net. For ease of handling, this rope is not tarred, but a preservative on the rope will increase the life somewhat.

Brails: Two brails are required for each net, for attachment at top and bottom of the lifting crib. The top brail is simply a length of 2 by 4, 10 feet long and fastened to loops at the top rear of the crib. The bottom brail is a length of $1\frac{1}{4}$-in. pipe, 10 feet long, attached to lower rear crib loops. The necessary loops are seamed to the net during manufacture.

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in the range mentioned, and fell somewhat only on changing the pH from 6.0 to 5.8.

At the highest pH values, myosin is inactivated exponentially at a rate depending on temperature, but not depending on pH value. From the temperature dependency of myosin inactivation the energy by activation of this reaction can be determined by the Arrhenius equation.

The data related to the inactivation of myosin at pH values from 6.0 to 6.3 (medium values) were particularly interesting. At temperatures of from 25° to 30°, inactivation of the protein at first progresses at a rate that is characteristic of the thermostable condition and then part of the protein goes over into the thermosensitive state. The lower the temperature and the greater the pH value within this "intermediate" range, the less of the thermosensitive component will be formed.

In the pH range 5.8 to 5.9 at temperatures of 30° to 35°, the transformation of myosin from one state to another progresses quickly and the slope of the curve reflects the rate of inactivation of both components. At temperatures of 20° to 25° the first portion of the inactivation curve evidently is determined simultaneously by two processes: formation of the thermolabile component and its inactivation.

Summary.--By change in the acidity of the solution the authors found the formation of several enzymatically active states of myosin which differ from one another in thermal sensitivity. The rate of thermal inactivation of myosin in the more thermolabile state is on the order of twice as great, but the energy barrier ($\Delta E \neq$ = 55 kcal. per mole) is less than in the thermostable state (ΔE = 77 kcal. per mole).

The more thermolabile component is formed from the thermostable one, as can be observed at temperatures of 20° to 30° and decrease in pH to 6.3 to 5.8. This transformation is reversible, but the quantitative ratio of both components depends on pH and on the temperature of the medium. The thermolabile enzymatically active state of myosin which occurs at definite pH changes and that change which occurs in irradiation differ sharply from one another in their properties.

Analysis of the literature suggests the general character of the transformation which myosin undergoes in common with a number of other proteins.

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Our knowledge of the commercial potential of the nonexploited species is very slight. With the limited funds available to date, most of the biological investigations have been concentrated on species of high current value. Some fragmentary studies and observations, however, verify the existence of substantial untapped fisheries. In Lake Michigan, studies by Bureau biologists show that the bloater chub, formerly a food source of the lake trout, has recently increased in numbers by at least 350 percent. In southern Green Bay, an arm of Lake Michigan, yellow perch have become so abundant that, at the advanced age of 7 years, only a small portion of the population is large enough to constitute a legal commercial resource. Smelt, marine fish originally planted as food for other fish, are now so numerous in all of the Great Lakes that catches are already as high as 15 million pounds annually. In Lake Erie, biologists reported sighting a school of fish, later identified as smelt, that measured 7 miles long and one-half mile wide.

Early in 1959, the Bureau of Commercial Fisheries Exploratory Fishing and Gear Research unit at Sandusky, Ohio, commenced studies designed to determine the commercial availability of smelt to trawling gear in Lake Erie. Smelt were found in the Central Basin and portions of the Eastern Basin from June to November. Catches with a Gulf of Mexico industrial fish trawl ranged from a few hundred pounds per drag to over 5,000 pounds per drag. During a 10-day demonstration effort, the Bureau of Commercial Fisheries vessel produced over 50,000 pounds of quality fish.

After viewing these results, a few Lake Erie commercial fishermen began trawling for smelt in Ohio waters on a limited scale. A few problems arose, such as difficulties in handling smelt during the warmer months, but most problems showed early indication of solution without serious difficulty.

At the same time, on the Canadian side of Lake Erie more than 20 commercial operators began trawl-fishing for smelt. Reports indicate that the fishery has continued profitably through February 1960.

2.114 HYDRAULIC DECK AUXILIARY MACHINERY

Berg, G. F.
Schiffbautechnik 8, 398 (Aug. 1958) (In German)
World Fisheries Abstracts 10, 9-10 (September-October 1959)

The installation of hydraulically driven deck machinery is becoming more and more common in many shipbuilding countries. Hydraulic drive is used for trawl, cargo, hoisting and warping winches, for capstans, and for the hoisting, luffing, and slowing mechanisms of deck cranes. It is also used for the remote control of hatch covers, the control of Diesel engines and clutches in reversing gear, and control gear for bulkhead doors. Other applications include stabilizing equipment, controllable-pitch propellers, and steering gear.

The main advantages of hydraulic drive compared with electric drive are as follows: (1) the generation of high forces and torques; (2) small dimensions and weight-power ratio; (3) good speed regulation over wide ranges; (4) simple production of large or variable transmission ratios; (5) high acceleration and retardation rates as a result of the small rotating masses in hydraulic motors; (6) simple and reliable equipment; (7) considerable saving in copper and, particularly with deck installations; (8) avoidance of insulation difficulties and losses. One of the disadvantages of hydraulic drive is the transmission of energy through piping. With moderate lengths of piping and through the use of high-pressure systems with their small dimensions and higher efficiencies, this limitation is not serious. Complicated problems of control which exist with steering gear, particularly with automatic control, are solved by the combined use of electric and hydraulic forms of energy.

The author goes on to discuss hydraulic drive for winches, and compares a hydraulically driven installation with a similar electrically driven one. It is shown that for the installation considered,

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2.117 GREAT LAKES FISHERMEN CONVERT GILLNETTERS TO TRAWLING VESSELS

Gordon, William G. and Browillard, Kieth (Great Lakes Exploration and Gear Research Laboratory, Ann Arbor, Michigan)
Fish Boat 5, 35-39 (July 1960)

The future of the Great Lakes fishing industry depends upon increasing the efficiency of production of existing fish stocks in order to deliver fish and fish products to the consumer at a price competitive with other domestic fisheries. To meet competition, some people in the industry have converted existing gillnet and trap-net vessels into commercial-scale trawlers.

The new trawl fishery is based on trawling for smelt, sculpins, alewives, and chubs in western and southern Lake Michigan. The new fishery also is developing in central and eastern Lake Erie where smelt, gizzard, shad, and burbot are caught.

The fish produced by the Lake Michigan trawl fishery mainly are sold to the extensive fur-farm industry that is firmly established in the Midwest. Efforts are being made by members of the technological and marketing staffs of the Bureau of Commercial Fisheries to extend the use of these fish and fish products to the pet-food and reduction industries. The large chubs are sorted out of the catch and utilized in the smoked-fish trade. The production of fish from Lake Erie is confined largely to smelt destined for processing or distribution in the New York and Chicago markets.

Within the past year, 12 of the large gillnet vessels have been converted to stern-set trawlers and now are producing fish in commercial quantities. Two firms have bought Gulf of Mexco "shrimpers" and about 10 other firms are expected to convert to trawling in the near future.

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 ABSTRACTER: Kathryn L. Osterhaug

2.118 NOW YOU CAN FREEZE YOUR CATCH AT SEA!

Anonymous
Fishing Gazette 77, 14-15, 32-33 (July 1960)

The Bureau of Commercial Fisheries is making available to the industry, at no charge, the preliminary plans for a fishing trawler designed to make commercial use of the methods developed by Bureau staff for freezing fish when and as caught at sea. The experimental work was done over a period of several years on the research vessel Delaware.

The plans are for a larger than normal New England trawler fitted to handle and tow its nets in the usual manner, but from the starboard side only. Because the vessel is fitted to trawl from one side only, the usual winch is replaced by two, single, drum winches, each set to serve its own gallows frame. The winches are self-spooling and hydraulically controlled from one station on the starboard bridge, from which all trawling operations can be observed.

After the fish are landed on deck, the operations differ from the usual system, but the same skills are involved. From the checker boards, the uneviscerated fish are sorted and placed loosely in nylon-mesh bags that hold from 50 to 75 pounds of fish. The filled bags are placed in the baskets of the freezer tank and circulated through the brine for from 2 to 3 hours, or until the fish are frozen. After the bags of fish are removed from the freezer, they are glazed with a spray of cold, salt water and placed in the hold for storage. When the trawler arrives back in port, the bags are removed from the hold and discharged to the dock by the use of a conveyor system.

The freezing equipment is a slight variation of that developed by the staff of the Bureau of Commercial Fisheries and used successfully on the research vessel, Delaware. The freezers consist of

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 ABSTRACTER: Kathryn L. Osterhaug

2.143 PUSH THE BUTTON - - THE FISH IS DEAD!

Anonymous
Canadian Fisherman 47, 17 (June 1960)

A harpoon designed to electrocute fish has been developed by engineers in Montreal, Canada. This device is designed principally for use in swordfishing, but it also can be used on halibut and on tuna while trolling. The electric harpoon is reported to be the first practical development of its kind and represents a new and important fishing technique.

Today, swordfishing is a skilled manual job as it has been for generations. The fish is located by lookout and the harpoon is thrust by hand. Skill then gives way to a tedious chase. A 500-pound swordfish has a lot of stamina and the wound from a 14-inch harpoon barb doesn't finish the job of catching the fish. Several hours of struggle at the end of a 500-foot line may be needed to tire the fish sufficiently to haul it aboard. The practice has been to fix a keg to the end of the line as a marker and put a man in a dory to keep watch. The parent ship later returns to pick up the catch and the dory.

This process is slow and wasteful, and also dangerous. The electric harpoon can eliminate many of these disadvantages. The prototype of the device had its first sea trials last fall off the coast of Nova Scotia. The unit was installed on a longliner out of Shelburne, Nova Scotia.

Sighting and harpooning the fish still depends on the sharpness of the lookout and the skill of the harpooner, but once the fish is hooked, it is dead. A powerful jolt of electricity kills it instantly.

An insulated cable takes the place of the usual rope line, and a push-button controls the current.

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 ABSTRACTER: Kathryn L. Osterhaug

HYDRAULIC DECK MACHINERY

TRAWLERS FOR THE GREAT LAKES

FREEZING FISH AT SEA

ELECTRIC HARPOON

2.117 (Cross Reference: 2.1121)

This article is intended as a general guide for those unfamiliar with trawling practices and presents suggestions for possible conversions from the traditional Great Lakes vessels to West Coast style stern-set trawlers.

Profitable fishing practice is contingent upon proper rigging of the vessel, adequate power, proper fishing gear, and efficient handling of the gear and catch.

Most Great Lakes fishing vessels require some alterations before they can be fitted out for trawling. Hull modification may pose the most serious drawback to the conversion of Great Lakes vessels. Most of these vessels are not constructed to carry large quantities of fish or to withstand the severe strain on framing and deck that is imposed by industrial trawling. Deck members must be strengthened before the mast and other deck gear are installed. A considerable portion of the superstructure also must be removed to permit these installations and allow for the efficient handling of the trawl gear.

A large carrying capacity for storage of the increased quantities of fish caught is necessary for profitable operation. A hold is desirable because the storage of large quantities of fish above deck results in a very tender and top heavy vessel. Vessels should have a hold capacity of over 20,000 pounds of fish plus an adequate amount of ice.

Trawling requires flexible power for varying speeds and load conditions. The engine preferably should be a diesel with reduction gear and propeller matched for the intended usage of the vessel.

A stout mast must be rigged amidships behind the house. A common practice is to construct this of steel pipe 6 to 10 inches in diameter. A heavy boom is hung on the mast. Most of the hoisting gear consists of a single tackle rigged near the end of the boom and a double tackle rigged a short distance below this.

The recommended size of trawling gear as related to vessel power is given below.

Horsepower	Trawl size (feet)	Trawl door size (feet)
60 to 90	38 to 42	5 to 6x3
115 to 165	45 to 55	$7\frac{1}{2}$x$3\frac{1}{3}$
170 to 200	60 to 75	8 to 9x4

2.143 (Cross Reference: 2.1129)

It can be operated either by the harpooner himself, or by the helmsman in the remote-control steering point up the mast. The fish are hauled in over the side or stern in the usual way but without even stopping the boat.

After one or two attempts, the crew of the longliner were able to land a fish in 2 minutes from the kill. With experience, the time was cut to 90 seconds.

The electric harpoon takes some of the glamour from swordfishing, but adds considerably to its commercial effectiveness. Unless the price of swordfish meat drops drastically, it is estimated that a ship can pay for the unit in a season and still make a good profit.

The unit works very simply, and the main item of equipment is the pulse generator. This is in effect a bank of powerful capacitors that convert the 32-volt power from the ship's standard battery to a peak charge of 600 amps. The shock can be repeated in waves of "pulses", but one pulse is enough to kill almost any fish.

One of the inherent disadvantages of earlier electronic killers was their effect on the meat of the fish or animal killed. Peculiar physiological changes take place in the body after electrocution, and other killers failed to overcome them. Careful control of pulse rate and frequency in the electric harpoon has solved the problems and,in fact,Government inspectors who tested meat of fish killed with the harpoon found it equal or superior to that of fish killed in the usual way.

The secret of this is that the fish don't have a chance to put up a fight. A harpooned fish consumes a lot of energy in its attempt to stay alive and the muscle activity produces quantities of lactic acid. Fish killed by the electric harpoon have no time to struggle, so develop no acidity.

The electric unit can be installed anywhere on board, the only connection being the existing storage battery. The unit comes with two 200-ft. harpoon lines, each with two separate 15-ft. dart lines. Accessories are available for use on halibut and tuna. For halibut, a metal-tipped probe takes the place of the harpoon and is used to kill the fish as they surface with the lines. For tuna, the device is wired directly to the hooks so that, in effect, the fish electrocute themselves as they bite.

2.114

the hydraulic motor with almost the same output specifications is essentially smaller and lighter than a D.C. motor. Thus, for a 10-kw. output, an enclosed D.C. motor weighs about 660 lb. (300 kg.), whereas the weight of the hydraulic motor is only 110 lb. (50 kg.). The pump in the hydraulic installation also has smaller dimensions than the corresponding D.C. generator. Reversing and speed variation is feasible with the aid of simple devices such as distributing slide valves or a hand-lever adjustment. The speed of rotation cannot only be regulated in steps, but it is infinitely variable. In this way, jerky movements, as well as the associated load peaks, are avoided.

The arrangement of hydraulic winches on board ship is discussed. Since the winches are not all used simultaneously, it is possible to feed several hydraulic motors from the pump. This makes it possible to install a power plant below deck consisting of the diesel or electric drives and pumps. Only the hydraulic motors and the associated control gear are then fitted on the separate deck machines. In cases where separate winches are to be driven or where the winches are situated in spaces protected from sea water, it is sometimes advantageous to build the hydraulic drive in one unit. Some examples of the hydraulic equipment available for winches and steering gear are described in detail. There are references and the article is followed by a discussion.

2.118

two identical independent units, each capable of freezing about 3,000 pounds of fish per hour in continuous operation. Each unit consists of a galvanized steel tank about 8 feet by 10 inches in section and the full depth of the hold. Within the tank is a removable frame carrying 15 baskets mounted on chain belts. The baskets are constructed of heavy galvanized steel mesh or expanded metal, 6-sided, about 28 inches diameter and 7 feet long, holding about 500 pounds of fish each. The frame extends above the deck to a convenient height for loading and unloading the baskets, and is protected by a suitable insulated casing. The basket-carrying chain-belts are moved at about 30 feet per minute by a hydraulic motor and may be stopped at any position. The tank is filled with brine maintained at about 5°F. by a suitable footage of finned pipe carrying the refrigerant. Provision is made for filtering, discharging, or replacing the brine by a motor-driven pump.

The two holds are cooled by a single system, with provision for shutting off either hold while continuing the operation of the other. Here also fin-coil pipes carry the refrigerant.

Fish holds.--The fish hold is divided into two entirely separate sections, each of approximately the same capacity. They are maintained at about 5°F. by a single refrigerating unit, but either can be shut off from the unit if required. It is thought that the best way to avoid the woes of shifting cargo is to use approximately a standard fish-hold pen arrangement, however, as air circulation is required in the refrigerated holds, all dividing pen-bulkheads and boards will be of heavy galvanized steel or aluminum mesh, suitably reinforced. It is believed that such pen-boards can be about 16 inches wide.

Access to the holds for loading will be by specially designed bunker hatches, although the usual center-line hatches will be provided for unloading. All hatches will be fitted with automatic neoprene, or similar, diaphragms, to minimize infiltration of warm air. As previously mentioned, unloading will be accomplished by portable, power-driven elevators.

The entire arrangement is intended to provide for the least possible personnel occupancy of the cold rooms and to diminish the cold air leakage through open hatches.

2.117 CONSTRUCTION OF ALUMINUM FISH ROOMS: STANCHIONS, POUND BOARDS AND LIGHT ALLOY FITTINGS

Anonymous
The Shipping World and World Shipbuilding 140, 449 (May 1959) (London)
World Fisheries Abstracts 10, 21-22 (September-October 1959)

The Northern Aluminum Co., Ltd. (Bush House, Aldwych, London, W. C. 2) has issued a new practical handbook entitled Notes on the Construction of Aluminum Fish Rooms. These notes are primarily intended to give guidance on the planning and construction of trawler fish rooms in which the stanchions, pound boards and associated fittings are of aluminum alloy.

General fish room arrangement.--The construction of an aluminum fish room follows accepted principles, with timber pound boards and galvanized steel stanchions replaced by suitable aluminum extrusions. It is usual to use aluminum for the permanent wing bulkheads. Aluminum linings have the advantage of being hygienic and easily cleaned. The pound boards should fit cleats on the stanchions to provide independent support for the shelf rest angles so that the vertical boards may be relieved of the direct load of the fish and ice from above. The shelves may be supported across the vertical boards themselves by means of a saddle section or a specially slotted rest bar. The shelf boards may normally be lighter than the vertical boards, although it is sometimes preferable to use the same section throughout, both in the interest of standardization and also to reduce the deflection of the shelves to a minimum.

Pound board section.--Section 20791, with an over-all depth of corrugation of ½ in. (1.27 cm.) and a weight of about 1.03 lb./ft. (1.53 kg./m.) is designed primarily to replace the usual 1 in. (2.54 cm.) timber board. It has an ample margin of strength both from the point of view of the loading of fish and ice, and of the safety of men standing or jumping on it, and passing each other during

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3.19 EFFECTS OF GAMMA IRRADIATION ON THE QUALITY AND STORAGE OF FISH

Amano, Keishi and Yamada, Kinjiro (Tokai Regional Fisheries Research Laboratory)
Bulletin of Tokai Regional Fisheries Research Laboratory No. 26, 51-59 (November 1959) (Tokyo, Japan)

Twenty-two species of fresh, raw fish were irradiated with 400 curie Co-60 source. Each fish was filleted, cut to a size of 5 cm. long, 4 cm. wide, and 1 cm. thick, and packed in polyethylene bags. The samples were irradiated at room temperature (22° to 28°C.) for 20 hours to a dosage of approximately one million r.e.p. After irradiation, the samples were stored in a refrigerator held between 2° and 4°C. Samples were examined in both the raw and cooked state for quality changes every 10 days by 10 laboratory panelists.

The results of the acceptability tests on the cooked samples during refrigerated storage is presented in table 2 (omitted). The storage life of the irradiated samples are compared with the unirradiated samples in table 3 (see over).

The translucency characteristic of raw muscle tissue of fresh flat fish was lost by irradiation, and the surface of the flesh turned into chalky yellow; this change was not observed in squid, octopus, clams, abalone, and oysters. The blood-red flesh of tuna changed to greenish-brown on irradiation. It was quite often observed that when irradiated fish was cooked, rancid odor, browning of flesh, and off-flavor became evident. The irradiated raw samples appeared more firm than control samples, but no appreciable difference in firmness was noted after cooking.

See table, over.

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 ABSTRACTER: David T. Miyauchi

3.12 THERMAL AND NONTHERMAL DEGRADATION OF ACRONIZE CHLORTETRACYCLINE IN FISH AND SOME SHELLFISH

Kline, E. F.; Abbey, A.; Firman, M. C.; and Hopper, P. F. (Food Industry Department, American Cyanamid Company, Princeton, New Jersey)
Food Technology 14, 305-308 (June 1960)

Introduction.--Quite recently the United States was added to the growing list of nations that permit the use of an antibiotic for maintaining the freshness of fish. Limited use of chlortetracycline was granted by the Food and Drug Administration in an order signed on April 14 and published in the Federal Register on April 21, 1959. The order permits the inclusion of this antibiotic in ice or in dip solutions for round (whole), gutted and headed fish, shucked scallops, and nonpeeled shrimp. Many investigators have conclusively shown the benefits of chlortetracycline in extending the edible life of fish, shellfish, and other perishables.

When chlortetracycline was applied according to the conditions prescribed by the manufacturer, very small amounts of the antibiotic were absorbed by the skin and flesh of fish. The present study was undertaken to determine the effect of several methods of processing on the degradation of varying amounts of chlortetracycline contained in fish flesh. In some of these experiments the amounts of chlortetracycline that were present in the flesh were much greater than would be used under commercial conditions. These large amounts were used to determine what level of chlortetracycline would be completely destroyed and what amount would remain when destruction of chlortetracycline was not completed.

Experimental.--Fish were treated by dipping them in solutions of chlortetracycline or by storing them in antibiotic ice. All assays for chlortetracycline were conducted on 5-g. samples that had been

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 ABSTRACTER: Martin Heerdt

3.19 BACTERIA AT LOW TEMPERATURES

Summer, W.
Modern Refrigeration 63, 597 (June 1960)

A group of cold-loving bacteria known as psychrophils are presenting problems to the refrigeration industry. The widely held assumption that these bacteria are not detrimental to the cold storage of foodstuffs has received a severe blow by the discovery that they are more common than formerly was thought. Psychrophils have been found in the intestines of salt- and fresh-water fish, in chilled and frozen meats, in raw and pasteurized milk, in cream and butter, and in a variety of other materials as well. To the bacteriologist, psychrophils are known by such names as serratia, achromobacter, flavobacterium, micrococci, and pseudomonas. These micro-organisms cause food spoilage at temperatures below 10°C.

Pseudomonas can play havoc in dairies by causing the formation of off-odor, flavor, and pigments in butter, cheese, and other dairy products. Chromogenic bacteria, those that cause discoloration by producing pigments, appear on chilled poultry during the early stages of low temperature storage. Pseudomonas strains prefer frozen pork and lamb and chilled poultry, but micrococci are responsible for the spoilage of chilled beef.

The metabolic functions and motility of some psychrophils are not inhibited by temperatures as low as -4° to -6°C., in fact they flourish most vigorously at from 3° to 5°C. Food transferred from a deep freeze to a domestic refrigerator is an ideal growth medium for cold-loving bacteria. Psychrophils produce indole and decompose protein. Indole has an offensive odor that is quickly perceptible because of its low threshold of stimulation.

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 ABSTRACTER: Kathryn L. Osterhaug

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dissected from whole fish or from ground steaks or fillets, homogenized with 20 ml. of pH 4.2 acid acetone in a Waring Blendor, and allowed to settle at refrigerator temperature. A modified paper disc, agar diffusion method of assay was used to evaluate the amounts of chlortetracycline that were present. Cooking procedures consisted of frying, broiling, boiling, and stewing. Before the fish were cooked, all were eviscerated and the head, tail, and fins were removed.

Results.--Frying flounder fillets in deep fat for 10 minutes completely degraded the chlortetracycline that was present in the fillets. After 5 minutes of frying, at least 40 percent of the fillets that originally contained 1 p.p.m. chlortetracycline gave negative assays. Pan frying was slightly more effective than broiling for deactivating chlortetracycline in flounder fillets. In either case, small residues of chlortetracycline remained in those fillets that originally had assayed 3 p.p.m. or more of chlortetracycline. The frying of oysters reduced the amount of chlortetracycline to an average of 16 percent of the level in the raw product, whereas stewing of oysters reduced it to an average of 25 percent of the original level of chlortetracycline. Frying removed all of the chlortetracycline in scallops that originally contained up to 0.23 mcg./g. Low levels of chlortetracycline in raw shrimp were less subject to destruction by boiling than were high levels of chlortetracycline, for example, 1.3 mcg./g.

Pickling processes reduced the activity of the chlortetracycline in the flesh of herring from 78 to 100 percent. This was probably due to leaching and degradation which occurred during the pickling process.

In canning experiments with haddock, salmon, sardines, and tuna, the prescribed retorting time for the canned product destroyed all of the chlortetracycline that was present in the samples tested. In fact, the chlortetracycline present in the samples probably was completely inactivated in one-half of the full retorting time.

In smoking experiments with Alaska cod and salmon, maximum loss of chlortetracycline occurred during the hot-smoking phase of the process. The smoke also provided some bactericidal activity, which caused difficulty in measuring the precise amount of chlortetracycline that was degraded during the process of smoking. The authors concluded that for average cooking conditions and normal pickling and smoking procedures, practically no chlortetracycline will remain if the recommended levels are not exceeded.

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Antibiotics have been found to be ineffective on psychrophils because antibiotic-resistant strains develop. Of the bactericidal agents that are available, only ultraviolet radiation can safely be used with food. The source of radiation is a special grade, quartz tube within which an electric discharge takes place at low pressure. Almost all of the ultraviolet power in a properly designed monokymatic tube is emitted at 2537 A, which means that emission is at the maximum bactericidal wave length.

In most cases, ultraviolet radiation is the only bactericide required. The additional safeguard of nascent oxygen and ozone as microbicidal agents is not essential. These gases readily oxidize fats and may cause off-flavors in meat, fat, butter, milk, and other susceptible products. Vegetable matter is not affected. This at once deprecates the use of equipments the germicidal action of which is based solely on ozone produced in a silent electric discharge. Special ultraviolet sterilizers can be made to yield maximum output at bactericidal wave length without also generating ozonogenic radiation. These rays stay completely suppressed. This is achieved not be using filters, but a specially prepared tube of pure quartz (not glass). Ultraviolet rays also destroy viruses and moulds. The latter are important as the cause of growth on meat known as "whiskers."

A combination of bactericidal and deodorizing radiation often is required in cold storage space and in refrigerated cargo ships where a variety of goods is carried at the time. Under such conditions, cross-tainting of the goods is likely to cause financial loss.

The arrangements of refrigerated air circulation vary greatly and range from small fan and freeze units used locally in chambers of moderate size, to centralized refrigerating stations providing huge volumes of air at low temperature for distribution to large cold-storage spaces. In small installations, the sterilizing unit may be arranged locally. In a plant where refrigerated air is distributed in ducts from a central freezer to the storage space, the air can be sterilized and deodorized centrally, or locally after emergence from the ducts. When treating the air centrally by radiation and nascent oxygen, bacteria and odors causing cross-tainting are taken care of simultaneously and away from the animal foods.

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their normal work in the fish room. On a length of 3½ ft. (1.07 m.) the failing load of this board is over 1,000 lb. (454 kg.). Under a load of 300 lb. (136 kg.) the board will deflect about 1 in. but will immediately regain its shape when the load is removed. Section 20829 is a dual-purpose board designed to carry, with a minimum of deflection, fish bulked to any normal depth, and at the same time to be suitable for use in the vertical partitions. This section should therefore be selected if only one type of board is to be used throughout the fish room, but in other cases 20791 may be used for all shelving and 20829 for the vertical boards. Special section 12919 was designed for use in distant-water trawlers as a dual-purpose board in conjunction with a slotted rest bar or saddle section to carry the shelving, and has sufficient strength to support the heavy loads, in lengths up to about 4 ft. (1.22 m.); 11301 is a slightly heavier alternative; and 20356 is a similar section strengthened locally for use as a vertical board where conditions are especially rigorous--in a deep hold with no stanchion cleats and where the length of board is well over 4 ft.

Fish room stanchions.--In Section RH 778, the taper of the jaws makes it possible to maintain the 1 in. gap without excessive thickness of the arms, and this taper has an incidental advantage in that if cleats are attached by riveting, any slight protrusion of the rivet in the inside will not foul the boards. This cleat is an ordinary angle section with a protrusion on one side, which enables it to be easily and accurately located on the stanchion. It may be secured by welding or riveting, using in the latter case either solid rivets or Chobert rivets, both of ¼ in.(6.35 mm.) diam. The Chobert rivets are quite efficient. It was found that a mean failing load for a typical cleat assembly of the type described was about 0.6 tons for each rivet, a figure which could not be exceeded by equivalent solid rivets in single shear.

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Table 3.--Effect of gamma rays on keeping quality of fish

Variety of material	Time required until onset of spoilage (days)	
	Irradiated sample	Control sample
Bluefin tuna (Honmaguro) Thunnus thynnus	>40	0 - 10
Skipjack (Katsuo) Katsuwonus pelamis	>50	0 - 10
Frigate mackerel (Sodagatsuo) Auxis thazard	>50	0 - 10
Yellowtail (Inada) (Buri) Seriola quinqueradiata	>50	0 - 10
Dog salmon (Sake) Oncorhynchus keta	40 - 50	0 - 10
Jack mackerel (Ma-aji) Trachurus japonicus	>50	0 - 10
Mackerel (Saba) Scomber japonicus	>50	20 - 30
Greenfish (Mejina) Girella punctata	>50	0 - 10
Pacific saury (Sanma) Cololabis saira	>40	10 - 20
Plaice (Hirame) Paralichthys olivaceus	>40	0 - 10
Porgy (Madai) Pagrosomus unicolor	>50	0 - 10
Japanese sea bass (Suzuki) Lateolabrax japonicus	>50	10 - 20
Barracuda (Yamatokamasu) Sphyraena japonica	>50	10 - 20
Takabe Labracoglossa argentiventris	>50	10 - 20
Conger eel (Maanago) Conger myriaster	>40	0 - 10
Squid (Surumeika) Ommastrephes sloani pacificus	30 - 40	0 - 20
Octopus (Madako) Octopus variabilis var. typicus	10 - 20 (?)	0 - 10
Prawn (Kurumaebi) Penaeus japonicus	10 - 20	0 - 10
Abalone (Awabi) Haliotis Sp.	>50 (?)	0 - 10 (?)
White clam (Hamaguri) Meretrix meretrix lusoria	0 - 10	0 - 10
Baby clam (Asari) Venerupis semidecussata	0 - 10	0 - 10
Oyster (Magaki) Ostrea (Crassostrea) gigas	0 - 10	0 - 10

The sign implies 'more than' the period indicated.

3.235 PREPARED FROZEN FOODS

Hanson, Helen L. (Western Regional Research Laboratory, Agricultural Research Service, U. S. Department of Agriculture, Albany, California)
Journal of the American Dietetic Association 36, 581-584 (June 1960)

The newest and most dynamic development in the frozen food industry is the tremendous growth of prepared and precooked foods. Studies conducted by scientists at the Western Regional Research Laboratories have been concerned with the development of principles that will assure prepared and precooked foods of high original quality and the retention of this quality for long periods during frozen storage.

The prepared food industry is utilizing these principles in developing a wide variety of products--meats in wine sauce; vegetables with a variety of seasonings and sauces; complete dinners and individual items; and hors d'oeuvres, foreign foods, and desserts that need only be defrosted or heated before serving.

Prepared frozen foods vary so in their formulation and composition that no rigid rules can be applied to guarantee an optimum quality product by the time it reaches the consumer. In some products, flavor stability is the most critical problem, whereas in others, problems of texture and appearance cause the greatest difficulty. Retention of smoothness in sauces and gravies, prevention of mushiness, color loss in vegetables, separation of egg- or starch-thickened desserts, and liquid separation and toughening of hard-cooked egg white are examples of the latter types of problems.

Flavor stability is influenced by a variety of factors including the following: (1) the nature of the original product, (2) processing methods, (3) packaging atmosphere, (4) temperature in commercial

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 ABSTRACTER: Kathryn L. Osterhaug

3.2383 FISH-IN-BAGS HOOK PLUS-SALES

Bloomberg, Ray
Food Engineering 32, 99 (June 1960)

A Seattle seafoods packer is now marketing vacuum-packed frozen fish steaks and fillets in triplex, extruded film pouches that are placed in window-type consumer cartons.

Dehydration and oxidation, major distribution problems with frozen fish, are significantly reduced by the new package. The pouch, reportedly, keeps fish sweet and fresh, without loss of color for at least 4 days after thawing when it is held at 45°F. In addition, the film bag reportedly extends product storage-life by more than two times that of conventionally packaged fish, fits snugly to the product, and remains crystal clear and frost-free.

The triple laminate bag is composed of 2-mil polyethylene for heat sealing on the inside and of $\frac{1}{2}$-mil Saran-coated Mylar for wear on the outside. Mylar gives the package its strength, whereas Saran protects the fish from ultraviolet rays and serves as a gas barrier. Each bag of frozen fish is packed in a box that is $6\frac{1}{4}$ by $6\frac{1}{4}$ inches in size, with a window for product visibility. Bold, green lettering is used on ends of this box to identify its contents. Shipping cases are coded green for halibut, red for salmon, blue for swordfish, and orange for other fish.

Steaks are cut 7/8 inches in thickness and vacuum packaged 12 ounces or more to each bag under 29 inches of vacuum by a flex-vac unit. This amount of vacuum when used with salmon is modified by the addition of a small quantity of food-grade nitrogen to prevent the loss of oil from the product.

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 ABSTRACTER: Martin Heerdt

3.238 PRELIMINARY INVESTIGATIONS ON THE USE OF GUNNY SACK AS A SIMPLE AND ECONOMICAL MEANS FOR STORING QUICK-FROZEN POMFRETS WITH SPECIAL REFERENCE TO PROTECTION AGAINST YELLOW DISCOLORATION DURING STORAGE

Anonymous
Indian Fisheries Bulletin 5, 19 (Jan. 1958) (In English) (New Delhi, India)
World Fisheries Abstracts 10, 25-26 (September-October 1959)

Gunny sacks sterilized in solutions containing 5 p.p.m. of available chlorine were filled with quick-frozen pomfrets (Stromateus spp.) and dipped in ice-cold water and stored at 0° to 5°F. (-22.8° to 20.6°C.). Another batch of quick-frozen pomfrets were individually glazed, packed in gunny sacks lined on the inside with moisture-proof paper using bitumen as the adhesive material, and stored also at 0° to 5°F. Periodically, samples were examined for quality. The results are shown in the table (see over).

The advantages claimed for a gunny sack are: (1) its fibers can absorb nearly 3 times its weight of water thus providing a formidable ice glaze; (2) the fiber can take up bactericidal substances when dipped in a bactericidal solution; (3) it is cheap and easy to handle not only during storage but also in marketing and transport.

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3.5 KINETICS OF PHOSPHATE-BUFFERED, RIBOSE-AMINO REACTIONS AT 40° AND 70% RELATIVE HUMIDITY: SYSTEMS RELATED TO THE 'BROWNING' OF DEHYDRATED AND SALT COD

Jones, N. R. (Torry Research Station, Aberdeen, Scotland)
Journal of the Science of Food and Agriculture 10, 615-624 (November 1959)

Introduction.--The development of browning discoloration and off-flavor in white fish and white meat is intimately associated with changes in the muscle extractives, particularly the free amino constituents and the free sugars. Fish is usually preserved in ice aboard ship before it is dehydrated or salted. The compounds in fish flesh that are subject to browning change considerably during this period of preservation in ice. These compounds include the free sugars, of which (1) glucose is important in browning during the early stages of chill storage and (2) ribose is important in browning during the latter stages. Browning is limited by the availability of free sugars. The average browning potential of fish during storage in ice does not change appreciably, except that the potential diminishes toward the end of a 19-day-period of storage.

The experiments reported in the present paper were carried out to ascertain the relative reactivities of the different nitrogeneous compounds present in muscle extractives. By reference to known concentrations, the authors hoped to determine the separate contributions of each compound toward discoloration of the flesh, particularly in processes where syneresis of the muscle proteins occurs and the extractives dehydrate and brown independently at the surface.

Experimental.--The browning reactivity of a number of amino compounds was measured in these experiments. Other compounds that were potential sources of reactive amino grouping also were investigated. The molar ratios of sugar to amino compound used in the experiments were

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 ABSTRACTER: Martin Heerdt

PRECOOKED FROZEN FOODS

STORING QUICK-FROZEN POMFRETS

FLEXIBLE VACUUM PACKAGE

BROWNING OF SALT COD

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Days	Stored in open room	Stored in ordinary sacks	Stored in moisture-proof lined sacks
191	Discoloration	No discoloration	No discoloration
283	Discoloration	No discoloration	No discoloration
346	Discoloration	Very slight discoloration	No discoloration
368	Discoloration	Distinct discolored spots	No discoloration

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operations, and (5) time of exposure to various temperatures.

Product and processing methods.--Problems that are inherent in the nature of the original product can be illustrated by comparing chicken and turkey. Chicken becomes rancid less rapidly than does turkey.

Processing methods also can influence flavor changes. Rancidity develops more rapidly in cooked than in raw poultry. A study of the flavor problem in turkeys has shown that greater rancidity developed when birds were roasted than when they were simmered or cooked under pressure. Rancidity is especially pronounced if the turkey fat is used in making gravy, but a sauce made with a stable fat actually increases the storage life of the meat by excluding air from the package. Adding antioxidants to the water in which the turkey is cooked retards rancidity in frozen meat that is covered with a sauce of gravy.

Packaging and storing.--The atmosphere immediately surrounding the food within the package is extremely important. As little air as possible should be admitted. Three different methods can be used to accomplish this: (1) air can be excluded by using a very tight-fitting vapor-proof package; (2) air is excluded when food is packed with sauce or gravy; and (3) air can be replaced in the package by an inert atmosphere such as nitrogen.

Temperature of storage is important in precooked and prepared frozen foods just as it is in uncooked foods. Rancidity was detected in 2 months at 20°F. in commercial samples of frozen, fried chicken, in 6 months at 10°F., and in 9 months at 0°F. Storage time, during which desirable flavors will be retained, depends on all of the above factors. By combining information on the original product, processing methods, packaged atmosphere, and temperature, the companies that produce and handle frozen foods can provide excellent products at retail.

3.5 (Cross Reference: 0.33, 3.6)

much greater than those usually found in muscle extractives. This was done in part to standardize conditions and in part to facilitate an accurate assessment of sugar loss during the reaction, particularly in the early stages, before a large-scale intervention of secondary reactions. The reactants were buffered at pH 6.89 (that of post rigor-trawled cod) before being lyophilized and the lyophilized preparations were equilibrated to 70 percent R.H. and 40°C. in preparation for browning. The buffering medium was orthophosphate, which is present to the extent of some 200 to 250 μmoles per gram in dehydrated fresh cod muscle.

Reactants investigated in phosphate-buffered, ribose-amino reactions were α-alanine, β-alanine, ammonia, anserine, aspartic acid, creatine, creatinine, glutamic acid, glycine, leucine, lysine, 1-methylhistidine, serine, taurine, trimethylamine, trimethylamine oxide, and valine. Other measurements included as a part of this study were (1) the fluorescence of phosphate-buffered sugar-amino reaction mixtures, (2) changes in ribose concentration in the absence of amino compounds, and (3) ribose-amino reactions in the absence of buffer.

Findings.--After a prolonged browning of muscle extractives under similar conditions, the loss of amino-acid was found to exceed the loss of sugar by a considerable amount. This was not unexpected on the basis of Hodge's scheme of the Amadori rearrangement in the integration of known reactions that lead to browning in sugar-amino systems. Many compounds that result from reaction chains can combine with further amino groupings; therefore, the authors suggest an examination of the reactivity of the early products of taurine- and anserine-sugar reactions with the remaining constituents of the extractive mixtures.

The present calculations indicate a drop in the overall relative browning potential of the amino constituents during chill storage. This information along with the earlier information on the limiting effect of the sugars in browning reactions helps to explain the reduced average browning of extractives from fish stored for longer than 9 to 10 days. Further work is in progress on the contributions of volatile bases and protein to the browning of whole muscle.

3.2383

True cod fillets, Alaska king crab meat, and other fillets also are packaged by the same process. Fillets are packed in pouches with an orange background for rex sole, light green for petrale sole, and yellow for cod.

Boil-in-bag seafood specialties such as halibut a la king, halibut in cheese sauce, curried shrimp, and crab Newburg are packaged in 4 ounces to a serving in thermolam poly-Mylar film. These packages are retailed in cartons that contain two servings and carry a full color photo of the product.

3.60 METHODS OF EVALUATING FREEZE-DRIED BEEF

Cole, L. J. N. and Smithies, W. R. (Defence Research Medical Laboratories, Toronto, Ontario, Canada)
Food Research 25, 363-371 (May-June 1960)

Introduction. --The adenosine triphosphatase activity and contractility of the fibrils from freeze-dried beef, prepared by the modified vacuum-contact drying process, has been reported by Hunt and Matheson (1958). They found that 20 to 60 percent of the activity and some of the contractility had been lost during drying. The authors of the present report were interested (1) in confirming those findings and (2) in making a more intensive survey of the effect of various freeze-drying methods. Hence, in this study, an attempt has been made to determine (1) what criteria might be applied as a means of assessing effectively the characteristics of freeze-dried beef, (2) whether there are great differences between freeze-dried and frozen beef when these criteria are applied, and (3) whether differences in the drying techniques of freeze-dried beef are reflected in the results of physico-chemical tests.

Because contractility is difficult to quantify, the criteria investigated have been salt solubility, adenosine triphosphatase activity, and electrophoretic mobility. Some cursory observations are also reported on the sedimentation behavior of the fraction extracted by strong salt solution.

Muscle proteins may be divided according to their solubility into four groups, as follows: (1) corpuscular proteins, which are soluble in dilute salt solution (of the order of 0.15M) at neutral pH, largely enzymic in nature, and include the haemproteins; (2) proteins of the muscle fiber which are soluble in stronger salt solution (ionic strength about 0.6) and established as a complex of myosin, actin, and tropomyosin; (3) proteins soluble in 0.1N NaOH and insoluble in high concentrations of salt solution; and (4) collagen and elastin, which are insoluble in 0.1N NaOH.

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 ABSTRACTER: Martin Heerdt

4.11 THE STRUCTURE OF PLASMALOGENS

Rapport, Maurice M. (Yeshiva University, New York, New York) and Alonzo, Nicholas F. (Marine Biological Laboratory, Woods Hole, Massachusetts)
Journal of Biological Chemistry 8, 1953-1956 (July 1960)

Introduction. --In a preceding paper, Francis and Kinsella (1955) established that almost all mammalian tissue plasmalogens (lipids that generate higher fatty aldehydes on hydrolysis) contain an α, β-unsaturated ether structure. This generalization was made possible by the use of two stoichiometric analytical methods that could be applied to total lipid extracts of animal tissue. Method 1, which is based on specific iodination, permits the determination of the α, β-unsaturated ether content; whereas method 2, which is based on p-nitrophenylhydrazone formation, permits the measurement of the quantity of higher fatty aldehyde liberated by mild acid hydrolysis.

It was of interest to apply these methods of analysis to lipid extracts of marine animals because of a recent report that the plasmalogen of a sea anemone, Anthopleura elegantissima, contained the aldehydogenic chain in the form of a glyceryl acetal instead of in α, β-unsaturated ether linkage. Bergmann and Landowne (1958) reported that the plasmalogen was exclusively of the choline type in Anthopleura elegantissima (whole animal), and Dumont (1958) described a similar finding for the plasmalogen in the posterior gills of the Chinese crab, Eriocheir sinensis.

Among mammalian tissues, the structural nature of the base has not been studied extensively, and only spermatozoa have been reported to have plasmalogen that contained choline exclusively. Skeletal muscle and heart muscle plasmalogens were of both choline and ethanolamine types in approximately equal concentrations; brain plasmalogens were predominantly in the ethanolamine fraction; and rat lymphosarcoma contained ethanolamine plasmalogens exclusively.

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 ABSTRACTER: Martin Heerdt

4.11 PAPER CHROMATOGRAPHY OF SATURATED, UNSATURATED AND HYDROXY FATTY ACIDS

Skipski, Vladimir P.; Arfin, Stuart M.; and Rapport, Maurice M. (Yeshiva University, New York, New York)
Archives of Biochemistry and Biophysics 87, 259-265 (April 1960)

Introduction. --Many papers dealing with reverse-phase paper chromatography of saturated and unsaturated long-chain fatty acids or their derivatives have been published. However, only a few of the published procedures include saturated fatty acids with 24 carbon atoms. Even less attention has been paid to the hydroxy fatty acids, and no method has been described for the separation on paper of homologs of 2-hydroxy fatty acids.

This paper presents an improved chromatographic separation of saturated long-chain fatty acids (C_{14} to C_{24}) that was achieved by development at elevated temperatures. The paper also describes methods for distinguishing between fatty acids and their hydroxylated analogs, and the separation and identification of a homologous series of 2-hydroxy fatty acids.

Experimental. --Myristic, palmitic, stearic, arachidic, behenic, 2-hydroxymyristic, 2-hydroxypalmitic, 2-hydroxystearic, oleic, cerebronic, and lignoceric acids were chromatographed on Whatman No. 1 paper.

Method of assay. --The method described permits the separation and identification of mixtures containing saturated, unsaturated, and 2-hydroxy long-chain fatty acids. A complete analysis of the fatty acid composition of a complex lipide can readily be carried out with less than 100 μg. of derived fatty acids when these are unsubstituted and about twice this quantity when the mixture contains hydroxy acids.

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4.21 KEEP YOUR EYE ON EPOXIDATION

Mellecker, John
Chemical Processing 23, 28-29, 103 (July 1960)

Epoxides, which are used as coatings, adhesives, and vinyl plasticizers, have developed into important industrial materials in the past war period.

The highly reactive epoxide group may be introduced into olefinic molecules that are present in natural oils by selective oxidation with organic peracids. Peracetic acid is most commonly used in industry.

Epoxy resins may be produced by the condensation of epoxides. Epichlorohydrin, for example, may be reacted with bisphenol A to produce an epoxy resin of industrial importance (figure 1, see over).

Epoxy compounds are useful as scavengers of hydrochloric acid, a normal degradation product of polyvinyl chloride. These compounds also provide plasticizing qualities.

A relatively new method of direct epoxidation has been developed that makes use of a solution of peracetic acid formed from acetaldehyde by air oxidation and pyrolysis of acetaldehydemonoperacetate. Peracetic acid is used directly for the epoxidation of unsaturated fats, fatty acid esters, and vegetable oils.

See figure, over.

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 ABSTRACTER: Donald C. Malins

EVALUATING FREEZE-DRIED BEEF

PAPER CHROMATOGRAPHY OF FATTY ACIDS

LIPIDS OF MARINE INVERTEBRATES

EPOXIDATION OF FATTY ACID ESTERS

4.11

The analysis is accomplished in three stages. First, the fatty acid chromatogram is developed with 90 to 95 percent acetic acid at 35° to 40°C. This chromatogram resolves saturated and unsaturated long-chain fatty acids from C_{14} to C_{24}, inclusive. "Critical pairs" are not separated; 2-hydroxy fatty acids move close to the front of the developing solvent and are thus not distinguishable from normal fatty acids with short chains. Second, another chromatogram is developed with a mixture of glacial acetic acid and perhydrol (9:1) at 35° to 40°C. With this system, saturated fatty acids show the same R_f values as before, whereas oxidation products of unsaturated fatty acids are not detectable as bismuth salts. This technique, which is more sensitive than iodine spray for revealing unsaturation, is used to determine the amount of unsaturated fatty acids in a "critical pair." The intensity of the bands formed by a "critical pair" with and without perhydrol is determined by comparison with the saturated component as a standard. The difference indicates the quantity of unsaturated acid. In cases where quantitative evaluation is desired, it is advisable to run a number of chromatograms until the band intensities of "unknown" and standard are almost identical.

The third stage is important when the "unknown" has hydroxy fatty acids. These may be separated and identified by running the chromatogram with 65 to 70 percent acetic acid at 35° to 40°C.

Application of elevated temperature during the development of chromatograms improved the separation as well as the solubility of fatty acids. This is especially important for such acids as lignoceric and behenic. Detection of spots at elevated temperature increases the sensitivity.

Since this study was completed, several reports in addition to those already referred to have appeared on the efficacy of elevated temperature for resolving fatty acids. For example, Fiker and Hajek (1959) have described the separation of C_{12} to C_{34} saturated acids at varying temperatures, and Buchanan (1959) has reported on the separation of C_{12} to C_{24} acids at 37°, 40°, and 45°C.

Forty-two references are cited.

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Figure 1—Epoxy Resins by the Condensation Method

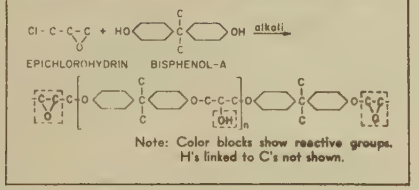

Figure 1. Epoxy resins by the condensation method

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Since it was desired to determine the effect of freeze-drying on those protein fractions of post-rigor muscle that are most likely to undergo change, namely, groups 1 and 2 fractionation of the same sample of beef was carried out in a stepwise manner from low to high ionic strength solution.

Drying techniques. --Four different techniques were used for drying the frozen muscle: (1) muscle, minced or in slices, was dried at 400 and 600 mc mercury pressure on a heated shelf at 30° and at 37°C.; (2) muscle slices were dried at 500 mc mercury pressure on spiked plates at a final maximum of 50°C.; (3) muscle slices were dried at 500 mc mercury pressure on a heated shelf at 90° to 100°C. for the first 2 hours and at 60°C. for the next 3 hours; (4) muscle slices were dried at 500 mc mercury pressure on heated blackened shelves at a final maximum of 50°C.

Results and discussion. -- Only a 3.7-percent decrease occurred in the amount of extractable nitrogen when frozen minced beef was treated in the stepwise fashion, therefore, it appeared possible to extract virtually all the actomyosin. Deformities of the protein, such as may be introduced by freeze-drying, appeared to be more readily detectable by the stepwise procedure than by the removal of sarcoplasmic and fibrillar proteins together, followed by precipitation of the latter. The data for freeze-dried and frozen minced beef extracted with mc 0.53 solution were identical except for a very small difference in extractable nitrogen. However, when fractionation was carried out by the stepwise procedure differences between frozen (control) and dried samples became apparent. Differences in extractable actomyosin nitrogen varied between 0 and 11.8 percent. The range of variation of extractable sarcoplasmic protein was smaller and showed greater consistency throughout. Prolonged heating at 37°C. appeared to have a considerable effect on the percentage of extractable actomyosin nitrogen. Electrophoretic patterns of mc 0.15 extracts from the various samples provided support for the foregoing evidence that few changes had been introduced.

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A third difference between mammalian and invertebrate plasmalogens was indicated by the studies of Karnovsky et al. (1955) on the digestive gland of the starfish, Asterias forbesi. According to their reports some of the material that gave a positive Schiff test was fuchsin-sulfurous acid, which was found in a neutral lipid fraction. In contrast, most evidence suggests that mammalian tissue plasmalogens are not found in lipid classes other than phosphatides.

Findings. --In the study reported here, total lipid extracts of eleven marine invertebrate species (sea urchin, starfish, whelk, squid, sea anemone, mussel, hard-shell clam, soft-shell clam, scallop, sea cucumber, and horseshoe crab) were examined for their content of aldehydogenic lipid and α, β-unsaturated ether. The lipids were then separated into neutral lipids, ninhydrin-positive phosphatides, and choline phosphatides on silicic acid columns under conditions that do not affect the labile enol ether bonds. These three fractions were studied for their aldehydogenic content. The authors found that the plasmalogens of these eleven marine animals contain the α, β-unsaturated ether structure and that this grouping is associated predominantly with the ninhydrin-positive (cephalin) fraction.

Their findings also showed that the unsaturated ether linkage accounts for almost all of the plasmalogen in eight species and for 75 to 85 percent of it in the other three species. Only a small portion of the total plasmalogen was found among the choline lipids. The concentration of plasmalogen in the lipids of many marine invertebrates was greater than 10 percent of the total or as high as that in the lipids of mammalian brain.

Marine animal lipids were found to behave differently from those of mammalian tissues with regard to the quantity of phosphatide that is only weakly adsorbed by silicic acid. For this reason the results do not provide a definite answer to the question of whether significant quantities of non-phosphatide plasmalogens occur naturally.

4.65 EFFECT OF FEEDING 1,2-DIHYDRO-6-ETHOXY-2,2,4-TRIMETHYLQUINOLINE TO CHICKENS

Gassner, F. X.; Buss, E. G.; Hopwood, M. L.; and Thompson, C. R.
Poultry Science 39, 524 (May 1960)

Introduction.--The stabilization of fat-soluble vitamins and pigments found in dehydrated forages and other feedstuffs against oxidation during storage has been a problem of feed manufacturers and livestock raisers for many years.

Screening experiments conducted at the Western Regional Research Laboratory with 400 antioxidants that are effective in rubber, plastics, gasoline, animal fats, vegetable oils, or foods showed that the 6-alkoxy substituted dehydroquinolines were more active than phenols, pyrogalol derivatives, naphthylamines, diphenylamines, phenylenediamines, and several other compounds for preserving provitamin A (carotene) in dehydrated alfalfa meal. These experiments were conducted by Thompson (1950 and 1951), Bickoff (1951), and Bickoff et al. (1952 and 1954). In addition, one of the dihydroquinolines, 1,2-dihydro-6-ethoxy-2,2,4-trimethylquinoline, which is commercially known as Santoquin, is almost completely miscible with oily vehicles and is available in quantity.

Previous studies of Wilson and Deeds (1959) and Wilson et al. (1959), showed that Santoquin had low acute and chronic toxicity for mice and rats. Thus, it was considered a very promising material for the stabilization of fat-soluble vitamins in feedstuffs. Before its use in poultry feeds was proposed, however, various toxicity studies on both growing and laying birds were carried out.

Experimental.--Santoquin was fed in graded single doses to chicks both on and off feed in amounts of up to 10 grams per kilogram of body weight. The LD-50 at 24 hours was about 10 grams per kilogram of body weight off feed and between 8 and 10 grams per kilogram of body weight on feed.

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 ABSTRACTER: Martin Heerdt

6.132 MULTIWALL PAPER CONTAINERS

Dowling, Thomas E. (Packaging Section, American Cyanamid Co., New York)
Chemical Engineering 67, 164, 166, 168 (May 16, 1960)

Introduction.--The multiwall paper shipping bag combines low initial cost with excellent product protection and light weight with minimum storage space. Multiwall bags also lend themselves perfectly to palletized shipments, or they can be readily handled in individual units by one man. They can be obtained in an almost unlimited range of capacities that will provide only as much strength as is needed to assure safe delivery of the product.

What is a multiwall bag?--Essentially, a multiwall shipping bag is a flexible container made from 2 to 6 plies of heavy-duty kraft paper, the minimum standards for which are outlined in Federal Specifications UU-S-48.

The principle of construction applicable in other laminated materials also applies to multiwall bags. This principal states that an item made of several lightweight plies will usually perform better than one made of fewer heavier weight plies. In a multiwall bag, the separate plies are usually made of 40-, 50-, 60-, or 70-pound basis weight paper. Basis weight is the weight per ream of 500 sheets of paper 24x36 inches in size. The separate plies also may be combined with various types of moisture barriers or other protective barriers. Construction depends on the type and quantity of material as well as other factors.

Total basis weight of a multiwall bag is the sum of the basis weights of each ply. It is standard practice in the trade to indicate the construction of a bag by listing the basis weight of each ply in sequence starting from the inside ply. Thus, 1/50, 1/60, 1/70 indicates a 3-ply bag with a 50-pound inner ply, a 60-pound center ply, and a 70-pound outer ply or a total basis weight of 180 pounds.

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 ABSTRACTER: Martin Heerdt

4.90 VITAMIN A NEWER APPLICATIONS FOR AN OLD VITAMIN

Wornick, Robert C. (Agricultural Development Department, Chas. Pfizer and Co., Inc.)
Western Feed and Seed 15, 22-24, 60 (June 1960)

Vitamin A is one of our oldest known vitamins, and many years of painstaking research have been required to unravel its chemistry and that of the carotenes, which are related to it, and to achieve their synthesis. Despite these major accomplishments, we still have much to learn about the role of these essential compounds in health and disease. Our slow progress is explained by the complex chemical structure of these compounds and by the fact that over a dozen different biologically active forms of vitamin A and natural carotenoids have been discovered.

The topics treated in this report are as follows: carotene versus vitamin A, biological availability, vitamin A products, stability, vitamin A feeding, and deficiencies and requirements. Under the last of these topics, the author discusses the deficiencies and requirements of broilers, layers, and breeders, swine, dairy cattle, beef cattle, and other animals.

In his conclusion, the author points out that the past 10 years have seen rapid advances in the field of vitamin A. Today, most manufactured feed products contain supplemental vitamin A in a highly stable, biologically available form. A wide variety of vitamin-A products are available to feed manufacturers, and satisfactory methods of production and of assay have been developed.

More knowledge is needed, however, on the role of vitamin A in healthy animals and on its relation to natural carotenoids. Important also is the need for data on the cause of vitamin A deficiency symptoms resulting from apparently adequate diets and for data on the exact function of the vitamin in enhancing resistance to many common diseases.

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 ABSTRACTER: F. Bruce Sanford

6.190 NUTRITION SYMPOSIUM OF NATIONAL FISHERIES INSTITUTE: FISH MEAL QUALITY

Culbertson, Steele (National Fisheries Institute)
Feedstuffs 32, 56, 65-66 (May 14, 1960)

This is a summary of a 3-year research program on fish meal quality conducted by Dr. Tom Runnels of the poultry department at the University of Delaware.

Experiment 1.--About 100 samples of fish meals were tested for comparative nutritive value by including a limited uniform amount of fish meal protein, in an otherwise complete practical broiler diet. All experimental diets were individually balanced with corn meal, soybean meal, bone meal, fat, and methionine to provide 21.5 percent protein, 0.5 percent methionine and a calorie-to-protein ratio of 45. The diets were also balanced to contain 1.05 percent calcium and 0.66 percent phosphorus. Fish meal provided 3 percent protein or about 14 percent of the total protein. Two control diets, one containing a particular menhaden fish meal and the other an all vegetable protein diet were fed in each series.

Randomly selected day-old White Rock cockerels were allotted to groups and were fed the comparative diets containing the various samples of fish meals from the first day. The groups were housed in battery brooders for 4 weeks at which time the chicks were weighed and food consumption was recorded. The groups then were transferred to growing battery cages and were fed the same diets. Gain in weight and food consumed were determined at the end of 7 and 10 weeks. Each group consisted of three pens, each containing 10 birds, for a total of 30 birds.

Results.--In two out of the first five experiments, nearly all groups of chicks fed the diets

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EFFECT OF SANTOQUIN ON CHICKENS

NEW APPLICATIONS FOR VITAMIN A

MULTIWALL PAPER CONTAINERS

FISH MEAL QUALITY

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Years will probably be required to obtain the answers. The author advises that meanwhile, livestock and poultry raisers can avoid serious difficulties by employing adequate levels of stable, dry, vitamin A products in their complete feeds and supplements.

A bibliography of 20 references has been provided.

Chronology of sources and forms of vitamin A:

1500 B. C.	Liver used as night-blindness cure in Egypt
1831 A. D.	Carotene first obtained from carrots by Wackenroder
1912	The name "vitamine" was originated by Funk
1913-15	Essential "fat-soluble factor" in butter and fish oil was announced by McCollum et al. and Osborne et al.
1919-20	Vitamin A activity of carotene discovery by Steenbock
1928-30	Chemistry of carotene was determined by Zechmeister et al.
1931	Chemistry of vitamin A was determined by Karrer et al.
1937	Vitamin A was first synthesized by Kuhn and Morris
1950	B-Carotene was first synthesized by Karrer et al.
1951	Gelatin-stabilized vitamin-A products introduced

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containing fish meal gained significantly more weight and utilized the feed better than the group fed the vegetable control diet with no fish meal. In the other three experiments, only a few such differences were found.

Quality of protein was equal for the commercially processed meals regardless of whether (1) steam or hot air cylindrical dryers were used in processing the meals, (2) meals were made from fresh or spoiled menhaden, or (3) meals were sampled before or after curing in a pile.

Experiment 2.--About 80 or more samples of commercially prepared meals were screened by the same procedure used previously. Statistical analyses indicated that no results were obtained that are contrary to findings obtained in the previous experiment. Growth data did not correlate (1) with catch data, (2) with proximate analysis of all authentic samples of fish meal, or (3) with the chemical identity of the compounds composing the Kjeldahl nitrogen fraction of 69 selected samples of meals.

Conclusions.--For all practical purposes, fish meals of normal commercial production are a reliable source of supplemental animal protein.

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Findings.--Chronic toxicity studies with graded levels of up to 0.075 percent of Santoquin in the diet showed that Santoquin had no significant effect on growth, feed consumption, livability, egg production, fertility of eggs, or hatchability of eggs. Studies on male fertility and its duration were inconclusive.

Progeny from birds raised on diets that contained Santoquin also showed that this substance had no effect on growth and livability.

Histological examination of liver, spleen, kidney, ovary, oviduct, and thyroid of hens showed no changes that could be correlated with treatment with Santoquin. Tissues of cockerels showed neither gross nor micropathology that could be ascribed to the treatment. However, the testes of birds on the two higher levels of Santoquin were larger than those of the control birds; whereas the thyroids of all treated birds were somewhat smaller than those of the untreated birds.

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This bag will have more flexibility and will out-perform a bag made of two 90-pound plies, even though the total basis weight of each bag is 180 pounds.

Cost and styles of bags.--Multiwall bags commonly used for the shipment of bulk chemicals, fertilizers, pigments, and cement can cost as little as 8 cents each or as much as 35 cents each. Cost is dictated by such factors as style, size, construction, quantity, and printing. The basic types of multiwall bags available are the open-mouth bag and the valve bag. Open-mouth bags have one end that has been closed by the manufacturer. The other end is closed by the user after he fills the bag. Generally, this end is closed by sewing; however, it may be tied, glued, or stapled. Valve bags have both ends closed by the manufacturer except that a small opening or valve is left in one corner through which the bag is filled. An appropriate paper sleeve or other device closes the valve. Both types of bags are supplied with either pasted or sewn and taped-end closures. There are, of course, many possible variations in construction styles, valves, and other details.

Product packability.--Almost every form of solid material may be packed in bags. Machines available for packing include screw packers, impellers packers, belt packers, auger packers, vacuum packers, gravity-feed packers, pressure packers, airslide packers, and various combinations of all these. Almost all materials in reasonably sized lumps can be successfully packaged in bags, molten products may even be charged into bags and allowed to harden into pigs for shipment.

Packing equipment.--Either valve or open-mouth bags can be filled at the rate of 10 to 15 bags per minute and higher with semiautomatic or completely automatic machines if desired.

Other features.--Bags for export obviously should be somewhat stronger than bags for domestic use and a moisture barrier should be added to protect against the uncertain weather conditions often encountered in this service. Such a barrier might be asphalt laminated kraft, metal foil, or polyethylene laminated paper. Export bags often have their outer plies made of wet-strength paper.

6.195 DEFATTED STARFISH MEAL AS SOURCE OF NUTRIENTS IN POULTRY RATIONS

Levin, Ezra; Rand, N. T.; Mosser, J. D.; Varner, D. S.; and Collins, V. K. (VioBin Corporation, Monticello, Illinois)
Poultry Science 39, 646 (May 1960)

Introduction.--The economic problems of utilizing starfish involve: (1) economical methods of harvesting to provide a raw material at low cost; (2) processing costs per unit of protein as compared to the conversion of fish into fish meal; (3) practical uses of starfish in feeds and foods.

The studies reported herein reveal: (1) that the protein of starfish is of high biological value; (2) that a mixture of defatted starfish meal and defatted whole fish meal appeared to be of higher biological value than either one alone; (3) that on an equal protein basis defatted starfish meal contains the same potency of unidentified growth factors as high-quality fish meal. Preliminary field studies revealed the availability of starfish in adequate quantities for commercial processing. Pilot plant investigations showed that processing by the azeotropic method (Levin 1959) could successfully extract the lipids and produce defatted starfish meal on a practical basis.

Experimental.--Fast-growing chicks of the New Hampshire X Columbian cross were used as experimental animals to evaluate defatted starfish meal; (1) for protein quality; (2) as a source of unidentified growth factors; and (3) in supplementing corn-soy rations. Each diet contained all vitamins and minerals known to be required by the growing chick and 1 percent corn oil as a source of essential fatty acids. Calcium was supplied as calcium carbonate, and phosphorus was supplied as monobasic sodium and potassium phosphates. In the assay for protein quality, which was based on a modification of a method by Hinners and Scott (1957), the protein source provided 1.6 percent nitrogen as a replacement for cerelose in the basal diet and kept the calcium and phosphorus contents

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 ABSTRACTER: Martin Heerdt

6.36 SEAWEED INDUSTRY ON THE MOVE

Anonymous
Chemical and Engineering News 38, 138 (June 20, 1960)

The seaweed industry expanded notably in 1959, according to the 1959 annual report of the Institute of Seaweed Research, Inveresk (Near Edinburgh), Scotland. Particular growth occurred in Ireland, where the interest aroused by the Third International Seaweed Symposium is still pulling new entrants into the seaweed meal industry. The output of Irish seaweed meal almost doubled last year. Much of this meal was sold in England at continually decreasing prices.

In Scotland, the output of seaweed meal dropped during 1959 because production costs and freight charges appear to favor the Irish seaweed mealmakers. The research institute believes that Scottish producers will continue to remain at a disadvantage until a sizeable local market is developed. New seaweed industries in Nova Scotia include a seaweed meal factory for the manufacture of animal feeds and a factory for the manufacture of alginates.

A plant for the manufacture of mannitol at the rate of 1-ton-per-day from seaweed recently was placed in operation in France. The estimated market value of seaweed products from this plant is about $364,000 a year.

In the pharmaceutical field, wound dressings that incorporate alginates are now being made. In Japan, hospitals are using a blood extender made from a mixture of sodium alginate and glucose in saline solution. The biggest pharmaceutical development in 1959, was the discovery that an extract of the red seaweed, Chondrus crispus, can inhibit the formation of peptic ulcers in experimental animals.

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 ABSTRACTER: Martin Heerdt

6.195 AMINO ACID IMBALANCE I.

Anonymous
Nutrition Reviews 18, 113-114 (April 1960)

A. E. Harper (J. Nutrition 68, 405[1959]) has defined amino acid imbalance as any change in the proportions of the amino acids in a diet resulting in "an adverse effect which can be prevented by supplementing the diet with a relatively small amount of the most limiting amino acid or acids." According to Harper, this leaves open the question of whether there are different types of amino acid imbalances, that is, whether imbalances caused by adding relatively small amounts of one or two amino acids to a diet are identical with those produced by adding a relatively large quantity of a protein or of an amino acid mixture lacking a single amino acid. It excludes, however, those conditions described as antagonisms and toxicities in which adverse effects are caused by the addition of a fairly large excess of a single amino acid and which are not known to be prevented by a relatively small supplement of the amino acid that is most limiting for growth. A. E. Harper has developed an hypothesis that appears to explain why dietary additions that cause quite severe imbalances in low protein diets are almost without effect when the protein level is sufficiently high to satisfy the amino acid requirements of the experimental subjects. The hypothesis is based on the fact that the growth response to a given increment of the amino acid that is most limiting in a diet diminishes when the growth rate becomes maximal. It follows that if the requirement for the limiting amino acid is increased by a constant amount when a quantity of an amino acid mixture causing an imbalance is added to a diet, then the growth-retarding effect of this addition should diminish as the dietary level of protein approaches adequacy.

Harper tested this hypothesis experimentally by determining the growth rates of male weanling rats ingesting diets containing: (1) a constant level of balanced protein but increasing increments of

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6.80 CLAM SHELLS KILL WASTE ACID

Cronan, C. S.
Chemical Engineering 67, 78 (June 13, 1960)

Mention clam shells and most engineers will probably bring to mind a day at the beach, a shore dinner, a cement plant, or a lime kiln. But apparently someone at a firm in Orange, Texas, recently visualized a different picture and saw this marine-life residue as a handy, inexpensive alkali. The result is a novel neutralization unit that lowers sodium hydroxide consumption by using clam shells to treat an acidic stream of waste.

The heart of the unit is a simple, wood-lined pit, 36 ft. long, 5 ft. wide, and 9 ft. deep that is kept filled with clam shells. Acidic waste enters at the rate of 300 gallons per minute through spargers at the bottom of the pit, passes upward through the shell bed, and overflows into an exit sump at a pH of 5.6. The stream then needs only token treatment with sodium hydroxide to meet a specified minimum disposal pH of 6. Residual sludge from the operation accumulates very slowly and needs to be removed only twice a year.

Noxious waste.--The final destination of the plant's acidic waste is a holding pond. Neutralization enroute to the pond is required to eliminate an organic acid that is notorious for its bad odor. Original acid content is 0.6 percent, one-half of which is nitric acid. This acidic waste was being neutralized entirely with sodium hydroxide until a pilot-study program showed that clam shells would provide a suitable substitute.

Construction.--Creosoted timber and stainless-steel bolts, nails, and pipings were used throughout the unit to prevent rotting or acid attack. Watertight construction was not required because the

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 ABSTRACTER: Martin Heerdt

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unbalanced protein, (2) a constant level of an unbalanced protein or amino acid mixture but increasing increments of balanced protein, and (3) either of the above proteins with increments of the amino acid most limiting for growth.

He found that the growth of rats fed a diet containing 6 percent of casein supplemented with methionine was stimulated by the addition of threonine. Gelatin, which contains threonine but not tryptophan, stimulated growth when added at a level of only 3 percent. However, when increments of gelatin greater than 3 percent were added, the rate of gain fell off until, with the addition of 12 percent of gelatin, the rate of gain was considerably less than that of the group fed only the basal diet. Addition of tryptophan, the most limiting amino acid, not only prevented this growth retardation but stimulated growth above that obtained with the basal diet.

According to Harper, an amino acid mixture that causes an imbalance will increase the need of the animal for the limiting amino acid by a constant percentage regardless of the original level of protein in the diet, but growth depression should be prevented by the same level of the limiting amino acid in each case. The magnitude of the growth depression caused by the addition of a stated amount of an imbalanced amino acid mixture to the diet, however, will depend upon the adequacy of the diet.

This reasoning provided the basis for a final experiment in which 4, 7, and 10 percent levels of casein, each supplemented with 0.3 percent of DL-methionine, were fed. Rat growth depression was greatest when the diet contained 7 percent of casein and was less if the diet contained either 4 or 10 percent of casein. However, regardless of the level of casein, the growth depression was not prevented by the addition of 0.05 percent of DL-threonine, but it was completely prevented by an addition of 0.1 percent. These results are in accord with the proposed theory.

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unit is located in clay soil that serves as a natural barrier to seepage. Piping was used to join the sump to an existing neutralization tank where the pit liquid is discharged at pH 5.6 and is brought to pH 6 with sodium hydroxide.

Operation betters expectations.--Pilot data led the engineers to expect a pit liquid discharge with a pH of 4.5 and a 60 percent reduction in the use of sodium hydroxide. When the unit was placed in operation, the operator found that the pit liquid discharge was consistently at pH 5.6 and that the savings in the use of sodium hydroxide amounted to 85 percent during the first 4 months of operation. The size of the unit is adequate to permit a liquid retention time of 55 minutes and weekend operation without the addition of fresh shells. Continuous operation of the unit is planned during the summer months, whereas intermittent operation is planned during the winter months.

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of the diets approximately constant at 1.2 percent and 0.6 percent, respectively.

Day-old-chicks were placed on a purified diet, considered to be nutritionally adequate, for a period of approximately 1 week (7 to 8 days). Then the chicks were individually wing-banded and were distributed into the experimental lots. All chicks were maintained in thermostatically controlled, electrically heated batteries equipped with raised wire floors. Each experimental diet was fed to a minimum of two replicates of 8 to 10 chicks, all of the same sex. Feed and water were given ad libitum. Chicks were individually weighed at intervals of 2 to 3 days, and the weight gain and feed intake were recorded for each group. Interpolation of the growth rates was made after an experimental period of 7 to 9 days to obtain the corresponding weight gain produced on a given intake of feed, which was referred to as an equalized gain. The latter was subsequently translated into a protein-quality value that was based on a comparison among three protein standards, namely: protein-free diet, Drackett assay protein C-1, and laboratory-made defatted fish meal (Rand et al. [1960]).

Results.--Protein concentrates prepared from starfish either by pancreatic digestion or by washing with hydrochloric acid, were found to have high protein-quality values that were comparable to good-quality fish meals. When 20 to 30 percent of starfish meal was incorporated into fish meal, the protein quality of the mixed product was increased. Defatted starfish meal was approximately equal to fish meal on a protein basis when added at levels of 3 to 6 percent in purified or practical diets while maintaining the same dietary level of calcium. The authors concluded that defatted starfish can compete nutritionally and economically with fish meal as a source of protein, calcium, and unidentified growth factors in poultry rations.

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The British Steel Castings Research Association, which has had encouraging results with sodium alginate in cores, is seeking a patent for the use of alginates in mold paints. Advantages claimed from the use of alginates in these paints are (1) that only a small amount of alginate is needed to give adequate suspending properties, (2) that ease of paint preparation is increased, and (3) that cracking tendencies of the paint during drying and shock heating are considerably reduced.

7.80 APPLICATION OF ORTHOGONAL POLYNOMIALS TO DATA ON PALATABILITY

Eisen, Jacob N.; Parks, Albert B.; and Dawson, Elsie H. (Human Nutrition Research Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.)
Food Technology 14, 237-239 (May 1960)

Introduction.--In regression analyses involving two variables, it is often necessary to fit a nonlinear regression curve to the data. By using orthogonal polynomials in this situation the goodness of fit of a straight line, quadratic, or higher degree curve, can be conveniently determined.

Davis and Elliot (1958) applied orthogonal polynomials in fitting a quadratic curve to calibration data on the vacuum of unopened cans. Several writers, Bennett et al. (1954), Goulden (1952), and Snedecor (1952), present examples illustrating how to use orthogonal polynomials when the values of the independent variable are equally spaced. For example, Goulden calculated a polynomial equation estimating enzyme activity from pH, and Bennett and Franklin fitted a regression curve to glass density at different temperatures.

Purpose.--The purpose of this paper is to illustrate the use of orthogonal polynomials with data on palatability in determining the simplest curve that appropriately represents the regression of one variable on another. In this example the values of the independent variable are equally spaced. A brief review of the method of orthogonal polynomials is first presented.

Findings.--Orthogonal polynomials were used to evaluate panel mean scores for the texture of stems of fresh broccoli cooked electronically for four, equally spaced times. The example illustrates how the sum of squares for "between cooking times" is partitioned into independent sums of squares for linear, quadratic, and cubic components of regression. It also shows how orthogonal

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8.50 A BIOCHEMICAL STUDY OF COHO SALMON (ONCORHYNCHUS KISUTCH) MATURING SEXUALLY IN AN AQUARIUM

MacLeod, Robert A.; Jonas, R. E. E.; and Onofrey, E. (Fisheries Research Board of Canada, Technological Station, Vancouver 8, British Columbia)
Journal of the Fisheries Research Board of Canada 17, 323-335 (May 1960)

Purpose.--This paper reports the results of a study to determine if a group of migrating coho salmon, captured where they entered fresh water en route to the spawning grounds would survive and spawn in an aquarium. Analyses of constituents of the blood and various tissues and measurements of the respiration rate and glycolytic activity of the tissues were made at intervals during the ripening period.

Experimental.--Adult migrating, coho salmon were transported in live tanks by truck to the Vancouver Aquarium from a trap located below the Cleveland Dam on the Capilano River, a distance of only 5 miles. Oxygen was bubbled into the water during transport. One 500-gallon tank and one 700-gallon tank was used to hold the fish at the aquarium.

Fish required for analysis were removed from the tank and transported alive to the laboratory (3 miles) in a box containing water into which oxygen was bubbled. At the laboratory, each fish was stunned by a blow on the head and weighed. Then its tail was removed and its blood was collected. Next, the fish was decapitated, and its organs were removed, weighed, and dropped into cold, saline solution (Krebs Medium II with the organic components replaced by an equal volume of 0.9 percent NaCl) (Krebs 1950). Parts of selected organs were sliced for respiration studies and homogenized for the determination of glycolytic activity. The remainder of each organ was then held at -20°C. for subsequent proximate analysis. Tissue protein was estimated by multiplying total nitrogen as determined by the micro-Kjeldahl procedure (Steyermark 1951) by 6.25. Fat was determined by

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ABSTRACTER: Martin Heerdt

8.51 AMINO-ACID COMPOSITION OF HERRING (CLUPEA HARENGUS) AND HERRING MEAL. DESTRUCTION OF AMINO-ACIDS DURING PROCESSING

Boge, Gjermund (Norwegian Fisheries Research Institute, P. O. Box 187, Bergen, Norway)
Journal of the Science of Food and Agriculture 11, 362-365 (July 1960)

Introduction.--The present paper reports studies by microbiological methods of the amino-acid composition of herring, intermediates, and byproducts obtained during the manufacture of herring meal, including a study of the effect of heating on the amino-acid contents during processing.

Experimental.--An average sample, from about 50 hectoliters of fresh herring that were caught off the West Coast of Norway in January, was used in the production of samples of herring press cake, herring press-cake meal, herring whole meal, herring press water, herring solubles, and spontaneously heated meal. The samples of press water and solubles were heated to 50°C., and the fat was removed after centrifugation. The press water was then condensed in vacuum at 45°C. to a dry matter-content of approximately 30 percent. The other samples were also dried in vacuum at 45°C. and extracted with light petroleum (boiling point 50° to 70°) in a Soxhlet extractor. Finally, the extracted samples were vacuum dried overnight at room temperature over calcium chloride.

Methods of analysis.--Dry matter was determined by drying in an oven for 4 hours at 105°C., except for the samples of press water and solubles, which were dried for 18 hours. Ash was determined by ignition of the dried samples in an oven for 18 hours at 540°C. Protein was calculated from the Kjeldahl nitrogen value multiplied by the factor 6.25. Amino acids were determined by microbiological methods and potentiometric titration of the lactic acid produced after incubation for 72 hours. An automatic dispenser titrator was employed, and all assays were carried out at a total volume of 2.0 ml. per tube. In all assays a sterilization time of 5 minutes at 120°C. was employed.

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ABSTRACTER: Martin Heerdt

8.51 THE ACID-SOLUBLE COLLAGEN OF COD SKIN

Young, E. Gordon and Lorimer, J. W. (Atlantic Regional Laboratory, Halifax, Nova Scotia, Canada)
Archives of Biochemistry and Biophysics 88, 373-381 (June 1960)

Introduction.--In a previous investigation by the authors, ichthyocol, an acid-soluble collagen, which is extractable from the fibrous tunic of cod swim bladder, was examined. The collagen of cod skin also has been referred to as ichthyocol, but its identity with collagen from the swim bladder has not been established. Collagen from cod skin has been reported to have a relatively low content of hydroxyproline, a low temperature of denaturation, and a low hydrothermal stability. The preparation and further characterization of this collagen is herein described. Collagen from cod skin is (1) of considerable interest in comparison with similar collagens from carp and from mammalian tissues and (2) of importance as the precursor of some commercial glues.

Materials.--Skins from the cod (Gadus callarias) were collected at the filleting machine in a commercial plant, frozen, held at -20°C., freed of adhering muscular and connective tissue by careful scraping, and cut into small pieces with a pair of scissors. All manipulations were carried out in a cold room or in refrigerated centrifuges at about 4°C.

Methods.--The skin was analyzed for moisture by drying in a vacuum oven at 105°C., for ash by ignition in a muffle furnace at 600°C., for total lipid by extraction in a Soxhlet apparatus, for organic nitrogen by micro-Kjeldahl, and for hydroxyproline by the method of Neuman and Logan as modified by Bowes, Elliott, and Moss (1955).

Other methods for the analysis of collagenous preparations were as follows: (1) total protein by quantitative biuret reaction, hexosamine by the Elson-Morgan reaction (1955), (2) amino acids by the

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The method of Dambergs (1956), and water was determined by drying previously weighed samples of the tissues at 105°C.

One portion of the blood was allowed to clot, and serum was recovered by centrifuging. Heparin was added to the remaining portion, and plasma was prepared. Serum and plasma were preserved at -20°C. for later analysis. Blood plasma was prepared from heparinized blood. Total protein in the plasma was calculated from the total nitrogen content (micro-Kjeldahl). Blood glucose values were obtained by application of the glucostat (glucose oxidase) procedure to the plasma. Protein-free blood filtrates were prepared by the Folin-Wu method as modified by Jacobs (1953). Nonprotein nitrogen was determined in the filtrates by the micro-Kjeldahl procedure. Amino acids were estimated colorimetrically with β-napthoquinone-4-sulphonic acid (Hawk et al. 1949). Na^+ and K^+ were determined in appropriately diluted blood serum by flame photometry and in flesh by procedures previously described (McBride and MacLeod 1956).

Respiratory quotients were determined with conventional Warburg apparatus using slices of liver, kidney, brain, and heart and bundles of separated fibers (Richardson et al. 1930) when skeletal and lateral line muscle tissue was under investigation. Unless otherwise indicated, the suspending medium in all experiments was that described by Krebs (1950) as Medium III. Glycolytic studies were conducted using 10 percent homogenates of each of the tissues in 0.25 M sucrose. Homogenates were prepared with a Potter-Elvehjem-type homogenizer with the aid of a Teflon pestle.

Results. -- This study revealed that sexual maturation of coho salmon can occur in an aquarium. The changes in body composition that occurred, however, were much less extensive than those that are normally observed in salmon under conditions of migration, owing most probably to the confinement and consequent inactivity of the fish. To obtain data on the changes of more quantitative significance, much larger numbers of fish than could be handled with the facilities available in this experiment would have to be used.

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method of Moore and Stein (1951) after hydrolysis for 48 hours with 6N HCl in a sealed tube at 105°C., (3) pH by the glass electrode, (4) electrophoresis in a Klett Tiselius-Longworth apparatus, (5) sedimentation in a Spinco model E ultracentrifuge, (6) optical rotation in a Rudolph high-precision polarimeter, (7) viscosity in Ubbelohde capillary viscometers, and (8) electron microscopy with a Metropolitan-Vickers Model EM3A microscope.

Findings. --Cod skin has been found to contain 75 percent collagen, 10 percent other protein, 2.5 percent peptides and free amino acids, 0.6 percent mucopolysaccharide, 1.0 percent lipid, and 12 percent ash. About 95 percent of the total solids were dissolved by repeated extraction of the skin with mild aqueous solvents of pH 3.4 to 8.7 at 3° to 90°C.

Collagen has been extracted with buffers of various organic hydroxy acids and their sodium salts at pH 3.6 and recovered as needle-like fibrils, which have characterized banding and are about 1 by 30 μ in size. This collagen contained 18.2 percent nitrogen, 0.02 percent hexosamine, 8.0 percent hydroxyproline (≏ 4.7 percent of the total nitrogen), and a distribution of 18 amino acids quantitatively identical with collagen from cod swim bladder.

The specific optical rotation changed from $[\alpha]_D^{5°}$ -349 ± 50° to $[\alpha]_D^{23°}$ -107 ± 2° and was partially reversible with time and temperature to $[\alpha]_D^{5°}$ -223 ± 12°. The value for S^0_{20W} was 3.17 ± 0.10 S, when measured at 6° to 9°C., and the value for $[\eta]$ was 12.8 ± 0.3 deciliter per gram when measured at 1.4°C. From these values the particle weight was calculated to be 280,000 ± 20,000 for an elongated rod of 12.1 A. diameter and 2810 A. length on the assumption of $\bar{v}$ = 0.700.

An irreversible change into two components occurred sharply at 13 ± 0.5°C., as clearly shown in the ultracentrifuge. The value of the mixture for $[\eta]$ was ~1.

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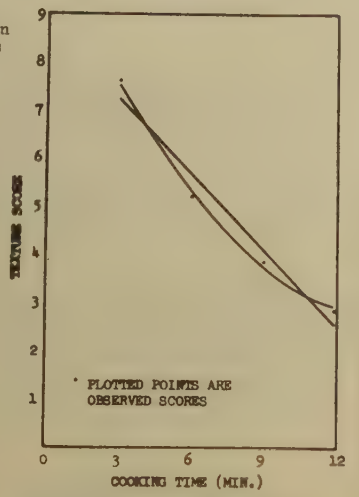
polynomials are applied in calculating the quadratic regression equation, $\hat{Y} = 10.53 - 1.103X + 0.039X^2$, for estimating scores for texture from various cooking times in minutes.

Orthogonal polynomials constitute a convenient method for determining the goodness of fit of a straight line, quadratic, or higher degree regression curve to such data as that on palatability. The method is useful in nonlinear regression involving two variables. By the use of orthogonal polynomials, the regression equation does not have to be recomputed whenever other terms are added.



Straight line and quadratic curve for regression of texture score on cooking time.

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Results. -- Amino-acid compositions of the various samples are tabulated below.

Amino-acid composition of samples

Amino-acid	Grams amino acid per 100 grams of crude protein (N x 6.25)						
	Whole herring	Press cake	Press-cake meal	Whole meal	Spontaneously heated meal	Press water	Solubles
Arginine	7.14	8.15	8.10	7.86	7.10	5.38	5.22
Histidine	1.87	2.03	2.10	1.84	1.46	1.21	0.69
Isoleucine	6.20	6.75	6.70	6.12	5.55	1.98	1.91
Leucine	7.14	7.45	7.60	6.85	6.30	3.29	3.24
Lysine	8.34	9.05	9.06	8.18	5.72	4.57	4.31
Methionine	2.56	2.65	2.72	2.49	2.22	1.32	1.36
Phenylalanine	3.57	3.85	3.87	3.35	3.26	1.61	1.54
Threonine	4.1	4.07	4.19	4.0	3.52	2.24	2.07
Tryptophan	0.78	0.82	0.81	0.72	0.52	0.156	0.099
Valine	5.38	5.74	5.85	5.33	4.74	2.57	2.46
Tyrosine	3.0	3.27	3.30	2.89	2.55	0.72	0.68
Cystine	1.4	1.6	1.6	1.3	0.95	0.42	0.08
Glycine	6.31	5.4	5.66	6.28	5.59	10.2	10.9
Alanine	7.64	7.71	7.45	7.45	7.04	7.29	7.89
Aspartic acid	9.42	9.90	9.82	9.10	8.80	4.96	4.92
Glutamic acid	11.44	12.05	12.03	11.75	10.6	7.73	7.53
Proline	4.23	4.34	4.32	4.6	4.1	4.6	4.8
Serine	4.1	4.5	4.63	4.15	4.05	2.9	- -

8.51 BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION XI. THE FREE HISTIDINE CONTENT OF THE TISSUES

Wood, J. D.; Duncan, D. W.; and Jackson, M. (Fisheries Research Board of Canada, Technological Station, Vancouver 8, British Columbia)
Journal of the Fisheries Research Board of Canada 17, 347-351 (May 1960)

Introduction.--A pure race of sockeye salmon (Oncorhynchus nerka) was sampled at different stages during spawning migration up the Fraser River (Idler and Tsuyuki 1958). Several reports on the biochemical changes occurring in these fish have been published (Idler and Tsuyuki 1958; Idler and Bitners 1958; Duncan and Tarr 1958; Wood 1958; Idler and Bitners 1959; Creelman and Tomlinson 1959; Idler et al. 1959; and Idler and Tsuyuki 1959). During the journey upstream the muscle non-protein nitrogenous constituents were found to remain reasonably constant with the exception of the histidine content which decreased markedly during the early stages of the migration and remained at the low level thereafter (Wood 1958). Because of this distinctive behavior of free histidine, it was thought desirable to study the changes, if any, in the histidine content of the tissues other than muscle during spawning migration.' This paper gives the results of such an investigation; the word histidine is used throughout in the sense of free histidine.

Experimental.--The fish were taken at three points during the migration: at Lummi Island, some 40 miles southeast of the mouth of the Fraser River, at Lillooet, 250 miles upstream, and at the Forfar Creek spawning grounds, 715 miles upstream.

Tissues, except muscle, were homogenized in water and centrifuged. Residues were resuspended in 95 percent ethanol and centrifuged. Aqueous and ethanolic supernatant fractions were combined. An aqueous solution of the extracted histidine was prepared from the ethanolic solution by the method of Awapara (1948). Muscle was extracted as described previously by Wood (1958). The method employed for the determination of histidine in the extracts was that described by Albanese et al. (1945), except that the 20-percent Na_2CO_3 solution was replaced by a solution containing 7.15

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 ABSTRACTER: Martin Heerdt

8.51 STUDIES ON THE PROTEINS OF FISH SKELETAL MUSCLE 7. DENATURATION AND AGGREGATION OF COD MYOSIN

Connell, J. J. (Torry Research Station, Aberdeen)
Biochemical Journal 75, 530-538 (June 1960)

Introduction.--Earlier papers in this series (Connell 1958) showed that, compared with rabbit myosin, cod myosin appears to be markedly unstable in the ease with which it aggregates. Since mysoin is the principal myofibrillar protein it seems likely that this instability is related to the general experience that the structural organization of cod muscle is much more easily damaged by, for example, dehydration or freezing than is mammalian muscle. Freezing and storing myosin or actomyosin in the frozen state produces complex aggregation and disaggregation reactions (Nord 1936; Snow 1950; Connell 1959) that are little understood.

The authors decided (1) to examine in detail the processes of denaturation and aggregation in solutions of myosin and (2) to study the effects on these processes of varying conditions such as protein concentration, ionic strength, and pH, which are likely to be altered markedly during freezing and drying. An attempt was made to measure both the intramolecular changes and the intermolecular changes that occur during the storage of unfrozen solutions of cod myosin at a temperature of 0°C.

Preparation of cod myosin.--Some of this work was carried out on 0.5 percent cod myosin that was prepared by disassociating cod actomyosin and separating the liberated myosin by means of preparative ultracentrifuging (Connell 1958). Other work was carried out on more concentrated solutions that were prepared by another method. To obtain concentrated solutions of cod myosin, the coarsely minced skeletal muscle of cod (Gadus callarias) was washed three or four times with phosphate buffer, pH 7.5, I 0.05 (Connell 1958) to remove the sarcoplasmic proteins; and the residue was

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 ABSTRACTER: Martin Heerdt

8.51 A PALE HAG-FISH

Rybak, B. (Laboratory of Zoophysiology, University of Caen)
Nature 185, 777-778 (March 12, 1960)

De Graaf (1957) and more recently Ewer (1959) have described specimens of Xenopus laevis lacking haemoglobin. In the course of an investigation on the physiology of the heart of the cyclostome Myxine glutinosa, I found on August 20 an animal about 25 cm. long which was remarkably pale, except in the caudal and dorsal regions, which were grey. Its blood appeared to have no pigmentation due to haemoglobin except near the gills, where there were some small localized red areas. All the blood vessels were cream in color as well as the heart, although the ventricle might have been pink. The liver was dark green and after fixation in 8 percent formol the principal dorsal vessels showed a light greenish coloration due perhaps to the destruction of haemin compounds. As for the gall bladder, it did not appear greener than normal.

When first observed, the animal was in the dark in circulating sea water at 15°C. among a mixture of hag fish, and showing as much vitality apparently as the other animals; it is particularly interesting to emphasize that this specimen had been caught at the same time as the others, 2 days before, in the Gullmars Fjord, Sweden, using G. Gustafson's technique, that is, by means of a large bottle containing some pieces of mackerel. Thus this animal, which is very poor in respiratory blood pigments, shows normal habits of feeding, proving that its olfactory organs were in good physiological condition. Hence the pathological state of the blood of this hag-fish leads one to ask what is the limiting role which could be taken by haemoglobin in the life of Myxine.

 Reprinted in part

8.59 BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION XII. LIVER GLYCOGEN

Chang, Violet M. and Idler, D. R.
Canadian Journal of Biochemistry and Physiology 38, 553-558 (June 1960)

Introduction.--During the 1957 Fraser River sockeye salmon run to Stuart Lake, an extensive program was initiated at the Vancouver, B. C. Station to investigate the biochemical changes that occur during spawning migration (Idler and Tsuyuki 1958). As a part of this program, the glycogen content of salmon livers was studied at various stages of the river migration of the 1959 Chilko Lake-migrants. The results are presented in this paper.

Materials and methods.--The liver samples were obtained from the 1959 Chilko Lake sockeye salmon-migrants at Albion (situated near the mouth of the Fraser River), at Siwash Bridge (358 miles upstream from Albion), and at the spawning grounds on the Chilcotin River. The fish at Albion were caught in a gill net and transferred to a live box, which was anchored beside the boat. The fish were processed as quickly as possible. A dip net was used to capture fish at Siwash Bridge, and a reef net was used on the spawning grounds. After the fish had been bled by severing the caudal artery, the livers were removed, immediately frozen in liquid nitrogen, and stored in separate polyethylene bags on dry ice. The frozen liver samples were individually powdered in a mortar with liquid nitrogen. Aliquots containing approximately 10 g. of liver were placed in 100-mg. beakers, covered with aluminum foil, and stored on dry ice until analyzed.

The livers were homogenized with trichloracetic acid in a Servall omnimixer at a speed of 14,000 r.p.m. The first extraction was carried out with 30 ml. of 10 percent trichloracetic acid for 5 min., after which the mixture was centrifuged at 12,000 r.p.m. for 15 min. The supernatant

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liquid was decanted, and the residue was extracted twice more with 30 ml. of 5 percent trichloracetic acid for 2 min. The supernatants from all extracts were combined and diluted to 100 ml. The procedure was carried out at 0°C.

Glycogen was precipitated by mixing 1 volume of trichloracetic acid extract with five volumes of absolute ethanol in a stoppered, conical centrifuge tube and refrigerating overnight. The precipitated glycogen was collected by centrifugation at 3,000 r.p.m. for 15 min. The supernatant was discarded, and the tubes were allowed to drain in an inverted position for at least 10 min. The residue was dissolved in a measured quantity of distilled water.

Glycogen was assayed with the anthrone reagent. The color was developed according to Carroll et al. (1956) and read in an Evelyn colorimeter using a 620 mμ filter.

Results.--The liver glycogen content of the male was found to be consistently greater than that of the female throughout the entire river migration. In both sexes, liver glycogen decreased during the early stage of migration and increased during the late stage. As a result, levels of liver glycogen in salmon at the spawning grounds were approximately twice as large as those in salmon at the mouth of the river. The changes that occurred are discussed in relation to sex expenditures of energy and levels of plasma steroid hormone.

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percent $NaBO_2$ + 5.7 percent Na_2CO_3. The color was measured within 1 minute of the dilution of the mixture.

Results.--The results of the histidine analyses are tabulated below.

Nonprotein histidine concentration in various tissues from sockeye salmon at different locations on the migratory route.

Tissue	Sex	Lummi Island	Lillooet	Forfar Creek
		Milligrams histidine per 100 grams tissue		
Heart	M	81.0 ± 11.5	87.3 ± 9.6	81.8 ± 38.8
	F	83.2 ± 15.2	91.0 ± 8.9	79.9 ± 5.9
Alimentary tract	M	138.4 ± 13.3	48.1 ± 12.2*	30.3 ± 10.7
	F	174.6 ± 39.2	40.0 ± 7.0*	20.3 ± 3.3*
Spleen	M	24.4 ± 3.7	24.4 ± 6.7	27.0 ± 5.9
	F	30.0 ± 5.9	27.0 ± 4.8	20.0 ± 5.9
Liver	M	21.1 ± 3.0	20.7 ± 1.8	16.3 ± 3.0
	F	23.3 ± 3.7	12.2 ± 0.4*	16.6 ± 0.7*
Kidney	M	37.0 ± 1.5	47.4 ± 5.5	46.6 ± 3.0
	F	51.4 ± 6.7	47.0 ± 3.3	50.7 ± 10.4
Blood	M		12.6 ± 1.5	12.9 ± 5.5
	F		15.5 ± 5.2	9.2 ± 0.7
Gonads	M	19.6 ± 2.6	15.2 ± 2.2	6.7 ± 3.3*
	F	6.7 ± 2.6	5.2 ± 1.1	3.7 ± 0.7
Muscle	M	40.0 ± 4.8	7.8 ± 0.7*	4.8 ± 0.4
	F	55.9 ± 3.0	10.0 ± 1.5*	11.5 ± 0.4
Head + skin + bones + tail	M	22.6 ± 1.1	12.9 ± 1.1*	9.2 ± 0.7
	F	22.9 ± 3.0	10.7 ± 3.0*	9.2 ± 0.7

* Difference from value at previous location is significant at P = 0.01.

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extracted at 0°C. by slowly stirring for 1 hour with 3 to 4 volumes of 0.45M KCl, 3.35 mM KH_2PO_4, 15.5 mM Na_2HPO_4, 10 mM tetrasodium pyrophosphate, 5 mM $MgCl_2$, at a final pH of 7.5. All of the protein preparations were made from muscle (sometimes frozen) that was excised before the onset of rigor mortis.

Methods.--Methods used for measuring diffusion, sedimentation, optical rotation, and viscosity were those described previously by Connell (1958).

Findings on general course of cod-myosin aggregation.--Changes in sedimentation occurred when cod myosin was stored at 0°C., similar changes occurred within the temperature range 0° to 23°C. In dilute solutions of greatly aggregated myosin, sometimes as many as five discrete peaks were visible. Measurements of the diffusion coefficient and of the weight-average M molecular weight show that the changes reflect a real increase in molecular weight and not, for example, an unlikely but possible stepwise alteration of shape at constant molecular weight. For aggregated samples the molecular weight fell progressively during the run, owing to the removal of heavier components from the meniscus.

After the stage when the monomeric myosin peak has disappeared from the ultracentrifuge diagram, the aggregates continued to grow in size. The total area under the peaks of the ultracentrifuge diagram did not change much even when the monomer peak had disappeared. This suggests that the formation of precipitable aggregates is slow. However, cod myosin does precipitate if kept long enough; and a 1.5-percent solution of the protein, if kept overnight at 23°C. and then for a week at 0°C., is converted into a rigid gel.

Other topics.--Also discussed under results were: kinetics of the aggregation; effect of temperature, ionic strength, and pH on the aggregation; effects of additives on the aggregation; changes in viscosity, optical rotation, sulphydryl groups, and ultraviolet-absorption spectrum; changes in adenosine triphosphatase activity during aggregation; and tryptic digestion of native and aggregated myosins.

8.59 THE PHOSPHORUS-CONTAINING FRACTIONS OF STERILE LINGCOD MUSCLE DURING STORAGE AT 0°C.

Tomlinson, Neil; Creelman, Vera M.; and Reid, K. G. (Fisheries Research Board of Canada, Technological Station, Vancouver 8, British Columbia)
Journal of the Fisheries Research Board of Canada 17, 371-376 (May 1960)

Introduction.--Information regarding changes that occur in the phosphorus-containing compounds of fish muscle post mortem is of a more or less fragmentary nature. Jones and Murray (1957), Murray and Jones (1958), and Saito et al. (1957a, 1957b, 1959) have made detailed studies of the changes that occur in the adenine nucleotides. Yamada (1948) and Fujimaki and Kojo (1953) have described changes in several components of the acid-soluble fraction of fish muscle, but only for periods of up to 3 days post mortem. Cardin et al. (1958) have reported the extensive breakdown of phospholipid in codfish undergoing Gaspe cure, and Lovern et al (1959) have measured the breakdown of phospholipid in codfish during extended storage in ice.

The authors desired to gain more insight into the changes that occur in each of the several phosphorus-containing fractions of fish muscle post mortem, in the absence of bacterial action. To obtain this information they examined fractions from sterile lingcod muscle that had been held at 0°C. for periods of up to 3 weeks. The ability of lingcod muscle extracts to release phosphorus from a variety of phosphorylated compounds also was examined.

Experimental.--Three lingcod (Ophiodon elongatus), weighing about 10 lb. each, were caught by hand line near Fisherman's Cove, British Columbia, and dispatched by a blow on the head. Approximately 5-g. samples of lateral-dorsal muscle from one side of the fish were quickly and aseptically removed and placed in previously weighed, sterile 22x105-mm. test tubes and plugged with cotton. A sample from each fish also was frozen immediately at -25°C. Other samples were held

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 ABSTRACTER: Martin Heerdt

8.612 VITAMIN A IN FISH FLESH

Hirao, Shuichi; Yamada, Juami; and Kikuchi, Ryo
Bulletin of Tokai Regional Fisheries Research Laboratory No. 25, 49-65 (August 1959)

A survey was made of the vitamin A content of the flesh of 157 species of fish available in Japan. Nearly 85 percent of the species examined contained less than 200 I.U. of vitamin A per 100 grams of flesh. Some species could, however, be recommended as rich sources of vitamin A in the human diet. These included (1) Squalus suckleyi, (2) Heteroscymnus longus, (3) Carcharhinus brachyurus, (4) Carcharhinus longimanus, (5) Astroconger myriaster, (6) Muraenesox cinereus, (7) Anguilla japonica, and (8) Entosphenus japonicus.

Although a majority of the species used for the present work consisted of one or two samples, it was previously reported by the authors that individual fluctuations in vitamin A contents in the flesh are by far smaller than those of livers and viscera. Therefore, the data in this paper are considered to serve as an outline of vitamin A content in fish flesh.

It may be worth noting that in such allied groups of fish as Entosphenus japonicus and Lamptera planeri; Heteroscymnus longus and Somniosus pacificus; Astroconger myriaster and Anago anago, remarkable difference has been observed in vitamin A content in the flesh despite their proximity in taxonomical relationship.

Eleven pages of tabular data are included.

 ABSTRACTER: Kathryn L. Osterhaug

8.59 DIGESTIVE ENZYMES OF FISH AND SEASONAL CHANGES IN THEIR ACTIVITY

Ananichev, A. V. (Institute of Biology of Reservoirs, Academy of Sciences U. S. S. R., Borok)
Biochemistry (U.S.S.R.) 24, 952-958 (November-December 1959)

Summary.--Seasonal differences were found in the activities of pepsin, trypsin, amylase, and lipase of the burbot, pike, perch, and bream, from the Rybinsk reservoir. Maximum activities were found for pepsin, trypsin, and lipase of these species to coincide with periods of intensive food intake; during the winter months for burbot, and during the summer months for pike, perch, and bream.

The amylase activity of all three species of fish was at a maximum during the periods of almost total abstention from food, and of preparation for spawning. Tryptic activity remains at a high level during these same periods.

The Michaelis constants of the digestive enzymes of fish, and their temperature dependences, differ very considerably from those of homeotherms. Their temperature optima tend to fall progressively with increasing duration of incubation. Their pH optima fall within the same ranges as for the corresponding enzymes of homeotherms.

The seasonal variations in the activities of the enzymes are due to differences in their rates of production at different seasons.

See table, over.

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 Author's summary

9.16 RACK OYSTER CULTURE HAS UNIQUE VERSATILITY

Anonymous
National Fisherman 41, 7, 35-36 (July 1960)

The Japanese system of collecting and growing oysters on racks is of particular interest because of the versatility of the method and the exceptional production rate that is attained. Oysters of commercial size are grown in a period of approximately 10 months. The rack-method is easily adapted to different growing areas; the oysters are protected from predators; and they are easy to harvest.

In rock culture the entire water column is utilized although very few oysters are planted on the bottom. In one part of Japan's Inland Sea that has less than one-third of the salt-water area of the State of Maryland, 20,000,000 pounds of oyster meats are harvested annually. The yield is about equal to that of the state of Virginia, which is the leading oyster-producing state in the United States.

As with traditional culture methods, the Japanese system starts with plain oyster shells. A hole is punched in the center of each shell and the shells are strung on a heavy steel wire. The strings of oyster shells are planted by being hung horizontally on wooden racks in shallow water or hung vertically from a raft in deep water in a known oyster-seed area during June. Microscopic, swimming oyster larvae attach themselves to these shells during June and July. By September, 10 to 15 oyster spats can be seen growing on each piece of shell. The seed shells now are removed from the water and strung on 20- to 30-foot wire with 8-inch bamboo spacers between each piece of seed shell. These growing strings are hung from 50- by 25-foot wooden rafts that are floated on wooden or steel, tar-painted drums.

Groups of growing rafts are moored in 25 to 30 feet of water in proven growing areas that are protected from large storm waves. By March or April the raft-grown oysters are 3 to 4 inches in length and are ready to go to the shucking house.

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 ABSTRACTER: Kathryn L. Osterhaug

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Table 1.--Activity of digestive enzymes of fishes at different seasons

Month	Monomolecular reaction constant, in min^{-1}			
	Pepsin	Trypsin	Amylase	Lipase
		Burbot		
February	0,0679	0,0291	0,0050	0,0232
May	0,0403	0,0129	0,0116	0,0348
July	0,0005	0,0090	0,0129	0,0057
October	0,0068	0,0084	0,0164	0,0051
		Pike perch		
February	0,0014	0,0098	0,0205	0,0070
May	0,0280	0,0064	0,0046	0,0174
July	0,0420	0,0101	0,0064	0,0271
October	0,0050	0,0020	0,0245	0,0184
		Bream		
February	0,0007	0,0088	0,0419	0,0035
May	0,0090	0,0123	0,0126	0,0319
July	0,0046	0,0129	0,0129	0,0251
October	0,0036	0,0063	0,0168	0,0177

9.16 (Cross Reference: 1.81)

This rapid culture method is known as hanging or suspended culture and may include a number of variations. Among the advantages of this system are (1) double growth rate results in the crop being produced in half the usual time; (2) any type of bottom and any depth of water is suitable; (3) the oysters are easily harvested; (4) it is easy to identify the crop as privately grown; and (5) the oysters are safe from crawling predators.

The disadvantages of the hanging method of oyster culture include the fact that (1) rafts and racks may be hazardous to navigation, (2) the raft and racks may be subject to wave damage, (3) the equipment used represents money invested, and (4) the labor involved represents a substantial cost.

Modifications of the raft method of culture include (1) the long-line method, (2) the rack method, and (3) the umbrella method. Umbrella culture utilizes a single, center pole projecting 1 or 2 feet above the bottom combined with sixteen 7-foot-long growing strings arranged radially between the center pole and stakes driven into the ground. The umbrella method is useful in areas where wave damage is a problem.

In the opinion of one professional engineer, the suspended-culture method will justify the labor and money involved and allow for a good profit in the culture of the Eastern oyster in the United States. The following cost figures show his reasoning. One oysterman can operate four rafts which cost about $400 each and are useable for 4 years. One raft will carry a maximum of 800 bushels of seed or market oysters. A seed-raft (or rack) requires 800 seed-strings costing about $1.00 per bushel of strung shell, and will produce a crop worth $1,600 ($2.00 per bushel of 6,000 spat per bushel seed) at the end of 3 months. Such a crop will be ample to "seed" six growing rafts.

A raft for growing oysters can produce 800 bushels of market oysters in 12 to 15 months by using 3-month-old seed worth about $3,000. The cost to "seed" the growing-raft with growing-strings costing about $3.00 per bushel works out to about $400 per raft. Since one man can operate four rafts, his first crop will cost roughly $1,600 for four rafts, $800 for seed-strings, $600 to seed the four rafts using his own seed, and $650 to harvest and run the oysters to market. The market crop will sell for about $12,000.

8.59

in a refrigerator at 0°C. After removal of the sterile samples, the fish were gutted, washed, placed in ice, and stored in a cold room at an ambient temperature of -2° to +5°C. At the end of 3 weeks these fish were in an advanced state of spoilage.

Tubed flesh samples were taken from the refrigerator after storage periods of 1, 7, 14, and 21 days and each sample was prodded with a sterile swab. Each of these swabs was transferred to a nutrient broth-yeast extract-artificial sea-water medium (Tomlinson and MacLeod 1957). After the swab was taken, each sample was frozen at -25°C. until it could be analyzed. At the end of 21 days' storage, samples also were taken from the lateral-dorsal muscle on the previously uncut side of the fish stored in ice, and these too were frozen until they could be analyzed for phosphorus fractions by the analytical procedure of Davidson et al. (1951).

Total phosphorus in each fraction was determined by the method of King (1932). Inorganic phosphorus in the acid-soluble, and in the ribonucleic acid-phospho-protein fraction, was precipitated by the method of Mathison (1909), washed with cold 2-percent ammonia solution, dissolved in acid, and measured by King's method. The combined inorganic phosphorus and acid- and molybdate-labile phosphorus, for example, phosphocreatine, ribose-1-phosphate, acetyl phosphate (Lowry and Lopez 1946) of the acid-soluble fraction was determined by a slight modification of King's method.

Results.--During refrigerated storage of sterile muscle for up to 3 weeks at 0°C., the portion of total phosphorus accounted for by inorganic phosphorus in the acid-soluble fraction increased from 75 percent to 96 percent. During the same period the phosphorus content of the phospholipid, ribonucleic acid, and deoxyribonucleic acid fractions remained unchanged. Phosphorus-containing fractions, from the fish held in ice for the same period, did not differ appreciably from those obtained from sterile muscle. An aqueous extract of lingcod muscle was shown to be able to form orthophosphate from a variety of phosphorylated compounds.

8.612

0.33 HETEROGENEITY OF PROTAMINES (CLUPEINE AND SALMINE) OBTAINED FROM SPERMATOZOA OF FISH

Ando, Toshio and Sawada, Fumio (Univ. Tokyo)
Chemical Abstracts 53, 19182d (October 25, 1959)

0.33 STUDIES ON THE BROWNING OF FISH FLESH I. BROWNING OF WHITE FLESH BY HEAT

Ono, Toyoki and Nagayama, Fumio
Bulletin of the Japanese Society of Scientific Fisheries 24, No. 10, 833-836 (1959) (English abstract and tables)

Free reducing sugars and the degree of browning increased in parallel with the length of storage of the flesh. Free reducing sugars were decreased by autoclaving. Browning did not occur in flounder flesh below 120°C., but the flesh was browned at 100°C. by the addition of glucose, and at 80°C. by the addition of ribose.

0.35 BIOCHEMICAL PATTERNS AND AUTOLYTIC ARTIFACT

Kavanau, J. Lee (Univ. of Calif., Berkeley)
Chemical Abstracts 54, 3565a (March 10, 1960)

0.35 BIOCHEMICAL STUDIES ON TUNA. I. EXTRACTION OF NUCLEIC ACID AND DETERMINATION OF BASE COMPOSITION

Fujii, Yutaka and Higasa, Shichiro (Nanakai-ku Suiken, Kochi)
Chemical Abstracts 54, 11312g (June 10, 1960)

0.35 BIOCHEMISTRY OF PIGMENTS

Goodwin, T. W. (Univ. Liverpool, Engl.)
Chemical Abstracts 54, 15723f (August 10, 1960)

2.02 THE EFFECT OF ATP ON THE VISCOSITY OF SQUID ACTOMYOSIN

Matsumoto, Juichiro J. (Tokai Regional Fisheries Research Laboratory)
Bulletin of Japanese Society of Scientific Fisheries 24, No. 5, 355-362 (1958) (In English)

Upon the addition of ATP to an actomyosin preparation of squid muscle a rapid decline in viscosity took place similar to that obtained with rabbit actomyosin.

2.02 LINGCOD MUSCLE PHOSPHOMONOESTERASES. I. ACID PHOSPHATASES THAT HYDROLYZE P-NITROPHENYL PHOSPHATE

Tomlinson, Neil and Warren, R. A. J.
Canadian Journal of Biochemistry and Physiology 38, 605-612 (June 1960)

(Abstract of this article appears under 8.59 page 15 - September 1960)

2.1126 EXPERIMENTAL FISHING TEST ON THE EFFICIENCY OF DOUBLE GILL NET

Nomura, Masatsune (Tokai Reg. Fish. Res. Lab., Tsukishima, Chuo-ku, Tokyo, Japan)
Bulletin of the Japanese Society of Scientific Fisheries 26, 103 (February 1960) (In English)

The author used rainbow trout to measure the fishing efficiency of a trammel net on a fish farm at Oizumu, Nagano Prefecture.

2.1127 THE WORLD'S LINE FISHERIES

Alverson, D. L.
Pacific Fisherman 56, 40-41 (April 1958)

(Abstract of this article appears under 2.1123 page 1 - August 1958)

2.1129 WHALING FOR POCKET MONEY

Tench, C. V.
Canadian Fisherman 46, 21-22 (February 1959)

(Abstract of this article appears under 1.953 page 3 - July 1959)

GLOSSARY OF COMMON AND SCIENTIFIC NAMES OF FISH AND SHELLFISH*

Common name	Other common names	Scientific name
Alewife	Branch herring, big-eyed herring, river herring,	Pomolobus pseudoharengus
	Blueback, glut herring, shad herring	Pomolobus aestivalis
Anchovy		Engraulis mordax
Cod	Codfish	Gadus morhua (Atlantic)
		Gadus macrocephalus (Pacific)
Flounder:		
Gray sole		Glyptocephalus cynoglossus
Lemon sole		Pseudopleuronectes dignabilis
Yellowtail	Dab	Limanda ferruginea
Dab	Sea dab	Hippoglossoides platessoides
Blackback	Winter flounder	Pseudopleuronectes americanus
Fluke	Summer flounder, gulf flounder, flounder	Paralichthys species
'Sole'		Pleuronectidae and Bothidae species
'California halibut'		Paralichthys californicus
Haddock		Melanogrammus aeglefinus
Halibut		Hippoglossus hippoglossus (Atlantic)
		Hippoglossus stenolepis (Pacific)
Herring:		
Lake	Herring	Leucichthys artedi (Great Lakes, except Erie)
Round		Etrumeus sadina
Sea		Clupea harengus (Atlantic)
Thread		Clupea pallasii (Pacific)
		Opisthonema oglinum
Jack mackerel	Horse mackerel	Trachurus symmetricus
Lingcod	Cultus cod, blue cod, buffalo cod, ling	Ophiodon elongatus
Mackerel		Scomber scombrus (Atlantic)
		Pneumatophorus diego (Pacific)
Crab:		
Blue		
Hard	Hard-shelled crab	Callinectes sapidus
Soft and peelers	Soft-shell crab	Callinectes sapidus
Dungeness		Cancer magister
King	Alaska king crab	Paralithodes camtschatica
Rock		Cancer irroratus (New England)
Stone		Cancer species (California)
		Menippe mercenaria
Lobster:		
Northern		Homarus americanus (Atlantic)
Spiny	Sea crawfish, rock lobster	Panulirus argus (Atlantic)
		Panulirus interruptus (Pacific)
Shrimp	Prawn	Penaeus setiferus (South)
		Penaeus duorarum (Atlantic)
		Penaeus aztecus and Xiphopeneus kroyeri Gulf)
		Pandalus species (Atlantic and Pacific)
		Pandalopsis species (Pacific)
		Crago species (Pacific)

Common name	Other common names	Scientific name
Menhaden	Mossbunker, pogy, fatback	Brevoortia species
Mullet	Jumping mullet, striped mullet, silver mullet	Mugil species
Ocean perch:		
Atlantic	Rosefish, redfish, red perch	Sebastes marinus
Pacific		Sebastodes alutus
Pilchard	Sardine	Sardinops caerulea
Pollock	Boston bluefish	Pollachius virens
Rockfish	Rock cod, snapper	Sebastodes species (Pacific)
Sablefish	Black cod	Anoplopoma fimbria
Salmon:		
Atlantic		Salmo salar (Atlantic)
Pacific:		
Chinook or king	Tyee, spring	Oncorhynchus tshawytscha
Chum or keta	Fall, dog	Oncorhynchus keta
Pink	Humpback	Oncorhynchus gorbuscha
Red or sockeye	Blueback	Oncorhynchus nerka
Silver or coho		Oncorhynchus kisutch
Spanish mackerel	Mackerel	Scomberomorus maculatus
Tuna and tunalike fishes:		
Albacore	Longfin tuna	Germo alalunga
	---	Thunnus saliens
Bluefin	Horse mackerel	Thunnus thynnus
	---	Thunnus secundodorsalis
Bonito		Sarda sarda (Atlantic)
		Sarda chiliensis (Pacific)
Little	Bonito, albacore, false albacore	Euthynnus alletteratus
Skipjack	Striped tuna	Katsuwonus pelamis
Yellowfin		Neothunnus macropterus
Whiting	Silver hake	Merluccius bilinearis
Clam:		
Cockle		Cardium corbis (Pacific)
Coquina	Pompano shells	Donax variabilis
	Butter	Saxidomus nuttali (Pacific)
Hard	Little neck	Paphia staminea (Pacific)
	Round clam, cherrystone, quahog, little neck	Venus mercenaria (Atlantic)
		Venus mortoni (Florida)
Ocean quahog		Cyprina islandica
Pismo		Tivela stultorum (Pacific)
Razor		Ensis species (Atlantic)
		Siliqua patula (Pacific)
Soft	Soft-shell clam, sand clam, nannynose, maninose	Mya arenaria
Surf	Skimmer	Spisula solidissima
Oyster:		
Eastern	Cove	Crassostrea virginica
Pacific (introduced)	Japanese	Crassostrea gigas
Western	Olympia, native	Ostrea lurida
Scallop:		
Bay		Pecten irradians (Atlantic)
		Pecten aequisulcatus (Pacific)
Sea		Pecten magellanicus

* Taken from Fishery Statistics of the United States 1955. Each species listed was caught in excess of 10,000,000 pounds in 1955.

2.144 FISH GATHERING EFFECTS AND SUBMARINE ILLUMINATION OF THE INCANDESCENT AND FLUORESCENT MERCURY-VAPOUR LAMPS

Kusaka, Takaya
Bulletin of the Japanese Society of Scientific Fisheries 25, No. 1, 17-21 (1959) (English abstract and figures)

The fish-gathering effect of the mercury vapor lamp was better than that of the incandescent lamp.

2.146 FISHING WITH SOUND

Shemanskiy, Yu A.
Priroda No. 2, 104-105 (1958)
Sport Fishery Abstracts 4, Abstract No. 2146 (January 1960)

Water is a better medium for transmitting sound than is air, and it has been shown that fish have a well-developed sense of hearing. Fish emit different sounds during different activities and can use their hearing as a sort of radar to detect the location of food and avoid obstacles around them, much as bats do. The author lists the various types of calls made by some fish. This is a great help to fishing vessels fitted with hydrolocation devices. Several "sound" baits and lures for amateur fishing are mentioned. There is one Soviet reference.

2.8 TEMPERATURE-TIME RELATIONS IN FOODS ON COOKING. I. BROILING

Matsuzawa, Kunio; Morimoto, Kiyo; and Nakamura, Atsuko
Chemical Abstracts 52, 14888 (September 10, 1958)

2.8 THE CHANGE OF DIGESTION RATE OF FISH PROTEIN WITH DIFFERENT COOKING METHODS

Ito, Kinue (Univ. Tottoir)
Chemical Abstracts 54, 12416d (June 25, 1960)

2.8 DEODORIZATION OF FISHINESS BY ADDING GINGER

Tomiyasu, Yukio; Toyomizu, Masamichi; and Takahashi, Kikuo (Kyushu Univ., Fukuoka)
Chemical Abstracts 54, 12415h (June 25, 1960)

2.9 (Cross Reference: 9.15)

EOSINOPHILE PHLEGMON OF THE SMALL INTESTINE DUE TO A WORM NOT NORMALLY PARASITIC IN MAN

Kuipers, Door F. C.; Van Thiel, P. H.; and Roskam, Th.
Overgedrukt uit het Nederlands Tijdschrift voor Geneeskunde. Faargang 104, 422-427 (February 1960)

Since 1955, 10 cases of an acute abdominal syndrome have occurred in Rotterdam-Schiedam and one in Hilversum. A surgically removed portion of the intestine (jejunum, ileum) was found to contain an eosinophile phlegmon enclosing a larva of Eustoma (= Anacanthocheilus) rotundatum. These nematodes are parasitic in herring and are not adapted to the human body. In all cases the source of the infection was very slightly salted herring. Data regarding the occurrence of these larvae in North Sea herring, their behavior in fresh and salted herring and their salt tolerance are presented. The distribution of the cases is found to be related to eating habits and changes in herring curing methods.

2.9 EXPERIMENTAL CIRRHOSIS OF THE LIVER, INDUCED BY SHELL-FISH POISON, WITH SPECIAL REFERENCE TO THE PATHOGENESIS OF FIBROSIS

Takahashi, Tadao; Serisawa, Shinroku; Oka, Shigeki; Sakita, Takao; Hosaka, Hiroaki; Iwamoto, Jun; and Yutaka, Uchimi (Univ. Tokyo)
Chemical Abstracts 54, 12382f (June 25, 1960)

3.12 STUDIES ON THE INFLUENCE OF TREATMENT IMMEDIATELY AFTER CATCHING UPON THE QUALITY OF FISH FLESH μ IV. USE OF CHLORTETRACYCLINE ICE FOR THE PRESERVATION OF SAURY, COLOLABIS SAIRA BREVOORT

Tsuchiya, Yasuhiko; Nomura, Tadashi; and Murase, Masahiko
Bulletin of the Japanese Society of Scientific Fisheries 25, 569-572 (November 1959) (English abstract, figures, and tables)

Saury retained its fresh quality for 8 days in plain ice and 17 days in CTC ice. At the beginning stage of CTC-icing, the flesh contained about 0.02 γ of CTC per gram of tissue, and thereafter the CTC content reached 0.16 ~ 0.34 γ per gram of tissue. Big saury contained a larger amount of CTC than did small ones, and the CTC content was lower in the dorsal and ventral part than in the caudal part.

3.12 CHEMICAL SIGNIFICANCE OF THE VOLATILE COMPONENTS OF SPICES IN THE FOOD PRESERVATIVE VIEWPOINT. IV. STRUCTURE AND ANTIBACTERIAL ACTIVITY OF TERPENES

Katayama, Teruhisa and Nagai, Isamu
Bulletin of the Japanese Society of Scientific Fisheries 26, 29-32 (January 1960)

The terpenoid compounds that showed antibacterial activity against Bacillus subtilis, Salmonella enteritidis, Staphylococcus aureus, Pseudomonas aeruginosa, Proteus morganii, and Escherichia coli in dilutions of 2,000 or over were eugenol, carvacrol, thymol, isoborneol, vanilline, and salicylaldehyde. Antibacterial activity of some volatile alcohols and aldehydes were also tested.

CONVERSION UNITS

1 pound = 453.59 grams
1 ounce = 28.350 grams
1 inch = 2.5400 centimeters
1 gallon = 128 ounces
1 gallon = 231 cubic inches
1 quart = 0.9463 liters
1 ounce = 29.573 milliliters

CONVERSION OF TEMPERATURE SCALES

$F = 9/5\ C + 32$

$C = 5/9\ (F-32)$

SPECIFIC HEAT AND HEAT OF FUSION

Average values of specific heat generally used for fishery products are 0.80 B.t.u. per pound per °F. above freezing and 0.40 B.t.u. per pound per °F. below freezing.

An average heat of fusion generally used for fishery products is 115 B.t.u. per pound. The heat of fusion of ice is 144 B.t.u. per pound.

DEFINITIONS

calorie ..... heat required to raise the temperature of 1 gram of water 1 degree Centigrade

British thermal unit .....252 calories or the heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit

ton of refrigeration ..... removal of heat at the rate of 12,000 B.t.u. per hour

atmospheric pressure, normal .....a pressure at sea level of 14.696 pounds per square inch, absolute

sensible heat .....heat added to the body when its temperature is changed

latent heat ..... heat absorbed or evolved during a change of state, with no change of temperature

heat of fusion ..... heat absorbed when a solid melts, with no change of temperature

heat of vaporization ..... heat absorbed when a liquid vaporizes, with no change of temperature

heat of reaction ....., heat evolved or absorbed during a chemical reaction

heat transmission .....flow of heat by conduction, convection, or radiation, singly or in any combination

horsepower .....,.. work performed at the rate of 550 foot pounds per second

mechanical equivalent of 1 B.t.u. of heat ..... heat given off by a total expenditure of 778 foot pounds of energy

COMMON ABBREVIATIONS*

A.	Ångstrom unit(s)
a.c.	alternating current
alc.	alcohol, alcoholic
alk.	alkaline (not alkali)
amp.	ampere(s)
anhyd.	anhydrous
aq.	aqueous
at.	atomic (not atom)
at. wt.	atomic weight
Bé.	Baumé
biol.	biological
B.O.D.	biochemical oxygen demand
b.p.	boiling point
B.t.u.	British thermal unit(s)
cal.	calorie(s)
cc.	cubic centimeter(s)
cm.	centimeter(s)
d.	density (d_{13} specific gravity at 13° referred to water at 4°; d_{20}^{20}, at 20° referred to water at the same temperature)
d.c.	direct current
e.m.f.	electromotive force
Et	ethyl (Et_2O, ethyl ether)
e.v.	electron volt(s)
f.p.	freezing point
ft.	foot, feet
g.	gram(s)
γ	microgram(s)
hr.	hour
in.	inch(es)
kcal.	kilocalorie(s)
kg.	kilogram(s)
kv.	kilovolt(s)
kv.-amp.	kilovolt-ampere(s)
kw.	kilowatt(s)
kw.-hr.	kilowatt-hour
l.	liter(s)
lb.	pound(s)
m.	meter(s); also (followed by a figure denoting temperature) melts at, melting at
M.	molar (as applied to concn.)
ma.	milliampere(s)
Mc.	megacycle
mc.	millicurie
Me	methyl (MeOH, methanol)
meq.	milliequivalent
m.e.v.	million electron volts
mg.	milligram(s)
ml.	milliliter(s)
mm.	millimeter(s)
mγ	millimicrogram
mμ	millimicron(s)
mol.	molecule, molecular
mol. wt.	molecular weight
m.p.	melting point
μ	micron(s)
mv.	millivolt(s)
n	index of refraction (n_D^{20} for 20° and sodium light)
N	normal (as applied to concn.)
petr. ether	petroleum ether
p.p.m.	parts per million
ppt.	precipitate
pptd.	precipitated
pptg.	precipitating
pptn.	precipitation
qual.	qualitative (not qualitatively)
quant.	quantitative (not quantitatively)
r.p.m.	revolutions per minute
sol.	soluble
soln.	solution
sp. gr.	specific gravity
sp. heat	specific heat
sp. vol.	specific volume
sq. cm.	square centimeter(s)
U.S.P.	United States Pharmacopeia
v.	volt(s)
vol.	volume (not volatile)
w.	watt(s)
wt.	weight

* These abbreviations are used by Chemical Abstracts and, accordingly, have wide recognition.

3.230 A NOTE ON THE BACTERIOLOGY OF PRAWNS AND THEIR PRESERVATION BY FREEZING

Sreenivasan, A.
J. Sci. Indus. Res. 18C, 119-120 (June 1959)
Bulletin de L'Institut International du Froid 40, No. 3, Abstract 8564 (1959) (Paris)

The prawns were decapitated and the shell and gut removed manually. They were then frozen in cartons by the air-blast method and stored at 0°F. The bacterial load on prawns at different stages of processing as well as during storage at 0°F. has been determined. The results indicate that the head carries the maximum bacterial load and hence must be removed. Although washing does not appreciably reduce the bacterial count, degutting helps to bring down the count. Prawns stored at 0°F., without shelling or degutting, turned dark within 2 weeks. Bacterial load is lower in shelled prawns than in unshelled prawns. Eighteen cultures have been isolated from the prawns. Of these, Micrococcus and Corynebacterium accounted for seven each, whereas Bacillus, Chromobacter, Flavobacterium, and Bacterium for one each.

3.230 HOW ABOUT ALL THOSE LOCAL VARIETIES OF FISH?

Anonymous
Seafood Merchandising 20, 23-26 (April 1960)

(Abstract of this article appears under 3.26 page 9 - August 1960)

3.33 MARINE SPORE-FORMING BACTERIA

Newton, Dorothy E.
Contributions to Canadian Biology (New Series) 1, No. 19 through 25, 379-400 (1924)

(Abstract of this article appears under 0.5 page 1 - September 1958)

3.33 OUR EXPERIENCE IN INTRODUCING COMPLEX MECHANIZATION

Orishich, K. P.
Rybnoe Khoziaistvo (Moskva) 34, 43-49

(Abstract of this article appears under 3.2 page 9 - October 1960)

3.330 PREPARATION OF FISH FOR CANNING

Empey, W. A. (Division of Food Preservation and Transport, C.S.I.R.O., Homebush, N.S.W.)
Food Preservation Quarterly 20, 8-12 (March 1960) (Sydney, Australia)

3.5 EFFECT OF THE CHEMICAL COMPOSITION OF SALT ON THE SALTING PROCESS AND QUALITY OF SALTED ROE

Mikulich, Ya. V.
Chemical Abstracts 54, 6993c (March 25, 1960)

3.5 EFFECT OF SALT PURITY ON THE SALTING PROCESS AND QUALITY OF SALTED FISH

Mikulich, Ya. V.
Chemical Abstracts 54, 6993e (March 25, 1960)

3.5 CHEMICAL CHARACTER OF SPOILAGE DUE TO SAPONIFICATION OF MILD-SALTED HERRING

Myasoedova, V. M. and Savchenko, R. A.
Chemical Abstracts 54, 6993f (March 25, 1960)

3.5 THE EFFECT OF PASTEURIZATION ON THE PROLONGATION OF THE STORING TIME OF CAVIAR OF THE SIBERIAN SALMON

Lapshin, I. I.
Chemical Abstracts 54, 7921c (April 25, 1960)

4.21 VOLATILE SUBSTANCES FORMED BY DECOMPOSITION OF THE PEROXIDES OF METHYL ESTERS OF HIGHLY UNSATURATED ACIDS

Toyama, Yoshiyuki and Suzuki, Katsuhito
Memoirs of the Faculty of Engineering, Nagoya University 6, 180-184 (November 1954)

Two samples of highly unsaturated methyl ester fractions prepared from sardine oil were oxidized with molecular oxygen at 0° to 25°C., and the oxidized esters of high peroxide values were obtained. The oxidized esters were then decomposed at 90° to 100°C. in a current of nitrogen, and the volatile decomposition products were collected and examined. Among the volatile acids, the presence of formic, acetic, and propionic acids were indicated. Found among the volatile aldehydes were unsaturated aldehydes such as crotonaldehyde, 2-pentenal and 2-hexenal in addition to saturated aldehydes consisting of n-hexenal, n-butanol and some lower members.

4.21 DECOMPOSITION OF PEROXIDES IN FATS WITH PARTICULAR REFERENCE TO THOSE IN SAURY OIL

Watanabe, Hisashi and Toyama, Yoshiyuki
Chemical Abstracts 53, 19409g (October 25, 1959)

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Applied Microbiology
Archives of Biochemistry and Biophysics
ASHRAE Journal
Bacteriological Reviews
Biochemical Journal
Biochemistry (U. S. S. R.)
Bulletin of the Chemical Society of Japan
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Biochemistry and Physiology
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Chemical Abstracts
Chemical Engineering
Chemical and Engineering News
Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmetic Industry
Federation Proceedings
Feed Bag
Feedstuffs
Fish Boat
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Preservation Quarterly
Food Processing
Food Research
Food Technology
Frosted Food Field
Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Bacteriology
Journal of Biochemistry (Japan)
Journal of Biological Chemistry
Journal of Lipid Research
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Japanese Biochemical Society
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Poultry Science
Progressive Fish-Culturist
Quick Frozen Foods
Science
Seafood Merchandising
Trade News (Fisheries Department, Canada)
Western Canner/Packer
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above-listed publications are included. Biological papers are generally omitted.

6.0 THE UTILIZING OF TRASH FISH--A NEW INDUSTRY IN THE MAKING

Robas, John S.
Fish Boat 4, 33-35, 38 (October 1959)

(Abstract of this article appears under 2.15 page 5 - February 1960)

6.132 PREPARATION OF "GALONGONG" (DECAPTERUS MACROSOMA) FISH MEAL AND ITS NUTRITIVE VALUE

Gonzalez, O. N.; Bersamin, S. V.; and Sulit, J. I. (Bur. Fisheries, Manila, Philippines)
Chemical Abstracts 53, 11698i (June 25, 1959)

6.132 NUTRIENT FROM THE BRAINS OF WHALES

Kondo, Heisaburo and Narita, Zoichi
Chemical Abstracts 53, 20618a (November 10, 1959)

6.19 METHODS FOR CALCULATING AMOUNTS OF CORN, SOYBEAN MEAL NEEDED TO OBTAIN SPECIFIC CALORIE: PROTEIN OR AMINO ACID RATIOS

Creek, R. D. (University of Maryland)
Feedstuffs 32, 18-20 (June 11, 1960)

Two separate computations are outlined here. Both are similar in approach in that they involve setting up the Calorie : Protein ratio, or its reciprocal, in algebraic form, and partitioning out the sources of energy, protein, or amino acids. In this manner the amounts of corn and soybean meal to give various Calorie : Protein or amino acid ratios may be accurately determined.

6.19 SUBSTITUTION EQUIVALENTS TO MAINTAIN CALORIE : PROTEIN BALANCE

Creek, R. D. (University of Maryland)
Feedstuffs 32, 34-35 (June 18, 1960)

6.32 LAMINARASE OF EUGLENA GRACILIS

Fellig, J. (Research Department, Union Carbide Chemicals Company, South Charleston, West Virginia)
Science 131, 832 (March 18, 1960)

An enzyme in extracts of the protistan Euglena gracilis splits the polysaccharide, laminarin (β-1 : 3-glucosan). Its optimal pH is 5.0, and it is activated by Mn^{++} ions.

6.32 RIBOFLAVINE CONTENT OF DRIED SEAWEEDS

Tanaka, Kiheiji (Univ. Nagoya)
Chemical Abstracts 54, 12404c (June 25, 1960)

6.32 FURCELLARAN, A VERSATILE SEAWEED EXTRACT

Schachat, Ralph E. and Glicksman, Martin (Gen. Foods, Tarrytown, N. Y.)
Chemical Abstracts 54, 14585a (July 25, 1960)

6.34 ADSORPTION OF THE FERRIC ION BY WEAKLY ACIDIC RESINS. PREFERENTIAL UPTAKE OF THE FERRIC ION BY ALGINIC ACID

Seno, Manabu and Yamabe, Takèo (The University of Tokyo, Yayoi-cho, Chiba, Japan)
Bulletin of the Chemical Society of Japan 33, 590-596 (May 1960)

Equilibration experiments revealed (1) that alginate resin adsorbs metal ions more extensively than Amberlite IRC-50 and (2) that the ferric ion is preferentially adsorbed by these resins, especially by alginate resin owing to a partial hydrolysis of the ferric ion and the formation of a complex between the ferric ion and alginate resin.

6.34 ALGINATE JELLIES

Merton, Robert R. and McDowell, Richard H. (Alginate Industries, Ltd.)
Chemical Abstracts 54, 12423h (June 25, 1960)

6.34 A METHOD FOR THE FRACTIONATION OF ALGINATES

McDowell, R. H. (Alginate Inds. Ltd., London)
Chemical Abstracts 54, 12425h (June 25, 1960)

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6.51 DEVELOPMENT OF THE OREGON PELLET DIET

Hublou, Wallace F.; Wallis, Joe; McKee, Thomas B.; Law, Duncan K.; Sinnhuber, Russell O.; and Yu, T. C. (Oregon Fish Commission, Clackamas) (Oregon State College, Corvallis)
Research Briefs, Oregon Fish Commission 7, 28-56 (1959)

Oregon soft pellets, composed of dry meals and fresh frozen fish products or beef liver, were fed to chinook (Oncorhynchus tshawytscha), silver (O. kisutch), and blueback salmon (O. nerka), and steelhead trout (Salmo gairdneri) during the course of nine feeding experiments. A comparison of food conversion and cost to produce a pound of fish showed that Oregon pellets are more efficient and economical to feed than existing hatchery diets of meat and fish products. Fish produced by the Oregon pellets were generally in good health, although problems of food rancidity, sporadic fish kills, and anemia were encountered. The cause of each is being studied. Recoveries of fish fin-marked at the termination of most of the feeding trials are still incomplete. However, in two trials for which recoveries are complete, fish fed the Oregon pellets were recovered in numbers at least as great as those fed the regular hatchery diets. Evidence was presented which indicated that the use of Oregon pellets may reduce the incidence of disease known to be propagated by feeding raw salmon products.

6.51 SHRIMP-WASTE MEAL: EFFECT OF STORAGE VARIABLES ON PIGMENT CONTENT

Rousseau, J. E., Jr.
Commercial Fisheries Review 22, 6-10 (April 1960)

(Abstract of this article appears under 6.14 page 13 - September 1960)

8.0 QUALITY OF FLATFISH FROM HAKODATE. PART 3 FACTORS DECIDING THE QUALITY. (2) RELATIONS BETWEEN THE QUALITY AND ORDINARY CHEMICAL CONSTITUENTS

Oishi, Keiichi
Bulletin of the Faculty of Fisheries, Hokkaido University 10, 131-146 (August 1959) (Hakodate, Japan) (English abstract)

The mean composition of 15 species of flatfish commonly found on the market in the Hakodate district, assayed as follows: moisture 79, ash 1, crude fat 2, and crude protein 18 percent, respectively. Fat content increases from autumn to winter and decreased both during the spawning season and from spring to summer.

8.0 PHYSIOLOGY OF MARINE TELEOSTS. I. IONIC COMPOSITION OF TISSUE

Becker, E. Lovell (Cornell Med. Center, New York, N. Y.); Bird, Robert; Kelley, John W.; Schilling, John; Solomon, Sidney; and Young Nelson
Chemical Abstracts 53, 16400d (September 10, 1959)

8.0 CHEMICAL COMPOSITION OF LOWER AND HIGHER CRUSTACEANS

Farkas, Tibor
Chemical Abstracts 53, 22550g (November 25, 1959)

8.51 PHARMACEUTICAL AND CHEMICAL STUDIES ON INSULIN XX. CRYSTALLINE PROTEINS ISOLATED FROM THE CRUDE TUNA INSULIN

Nagasawa, Kakuma; Nishizaki, Sasao, Hiraoka, Takashi; and Fukasawa, Shinji
Chemical Abstracts 52, 16429 (October 10, 1958)

XXII. The crystalline protein isolated from the crude insulin of tunny and the amino acid composition of inactive crystalline insulin. Ibid. 53, 22528h (November 25, 1959).

XXIII. Spherical insulin crystals obtained from the crude insulin powder of bonito. Ibid. 53, 22529a (November 25, 1959).

8.51 AMINO ACID COMPOSITION OF THE PROTEIN AND INORGANIC CONSTITUENTS OF THE ASH OF POLLOCK FISH SCALES

Snyder, Donald G.
Commercial Fisheries Review 20, 4-9 (August 1958)

(Abstract of this article appears under 6.190 page 17 - February 1959)

9.11 ON THE SURFACE CURRENTS IN THE WATERS FISHED BY JAPANESE SALMON MOTHERSHIPS FROM THE RESULTS OF DRIFT FLOAT EXPERIMENTS

Taguchi, Kisaburo
Bulletin of the Japanese Society of Scientific Fisheries 25, 117-121 (June 1959) (English abstract, table, and figures)

The water current between Kamchatka Peninsula and the western Aleutian Islands are in an anticlockwise motion during the summer season.

9.11 OCEANOGRAPHY AND FISHERIES

Kask, J. L. (Fisheries Research Board of Canada)
Canadian Fisheries Annual, pp. 49-54 (1960) (Gardenvale, Quebec, Canada)

Canada has made great strides in the study of oceanography as a means of assuring the future of the fishing industry.

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